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JANUARY 1986

PRODUCTION

FOR MANAGERS OF MANUFACTURING TECHNOLOGY

Over 25 Exclusive Reports On The Year Ahead In Manufacturing

WORLD OUTLOOK '86

PRODUCTION'S CAPITAL SPENDING SURVEY: HOW MANUFACTURERS WILL BUY THIS YEAR

TECHNOLOGIES THAT WILL IMPACT YOUR [illegible]ESS THIS YEAR

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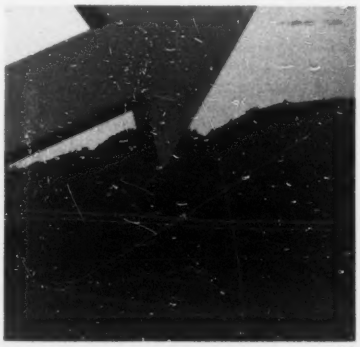
PRODUCTION

JANUARY 1986 COVER-TO-COVER VOL. 97 NO. 1



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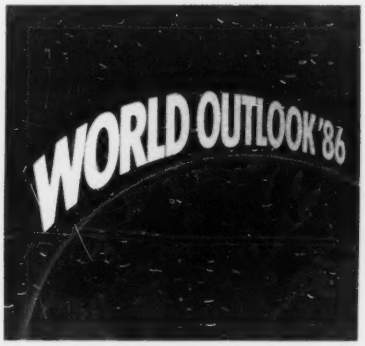

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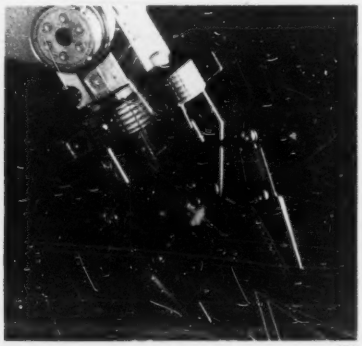

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to $4.0 billion this year after a 12 pct jump last year.

For the economy as a whole majority-owned affiliates plan to increase capital expenditures 2 pct this year to $40.9 billion after increasing their investment by 15 pct last year. However, said the Bureau, even if the increases planned for both years are realized, spending this year will be below the levels of 1980-82.

The 15 pct increase in spending expected last year probably reflects a decline in interest rates and the moderate economic recovery abroad, the BEA said. Based on previous experience, the 1985 spending estimate may be revised downward in later surveys, the government said.

The small increase planned for 1986 may partly reflect investors' uncertainty about the future pace of the business recovery abroad and the foreign currency value of the dollar, the Bureau said.

–Ed Bowers

WASHINGTON

New Orders At a Standstill NAPM Says

The U.S. economy maintained its steady pace in September according to the National Association of Purchasing Management.

In its latest report the group said production levels remained unchanged in October and new orders, the source of future production, eased only slightly. Vendor deliveries continued at just about the same pace. Employment picked up, but was still low and inventories declined as manufacturers began making seasonal adjustments.

The composite index of indicators, a broad measure adjusted for seasonal variations, rose to 51.7, up from 51 in September. October was the second consecutive month that the index surpassed the 50 level, having stayed lower for a seven-month period. A reading below 50 indicates that the economy is contracting. A reading above 50 indicates that it is expanding.

The report is based on a survey of purchasing managers at 250 major companies in 21 industries.

Production showed little change. The study indicated that 26 pct of the respondents noted that output was up, compared with 23 pct in September. Twenty pct indicated that production had declined compared with 17 pct the previous month.

New orders eased after rebounding in September, the NAPM said. Twenty-seven pct of the managers mentioned an improvement compared with 34 pct in September. Another 27 pct reported a slowdown compared with 20 pct previously.

A slowdown in vendor deliveries that had been noted in September continued in October, according to the survey.

For the eleventh month in a row, more purchasers reported paying lower, rather than higher prices. Also, no commodities were reported to be in short supply and only one product—diesel fuel—was reported to have gone up in price.

Reported as lower in price were corrugated shipping containers, caustic soda, phenol, aluminum, steel and soybean and vegetable oils.

A decrease in lead times for capital expenditures was also reported for October. The number of respondents reporting lead times of six months and longer decreased in the tenth month to 48 pct from 52 pct in September. However, the NAPM noted that lead times for production materials lengthened.

–Ed Bowers

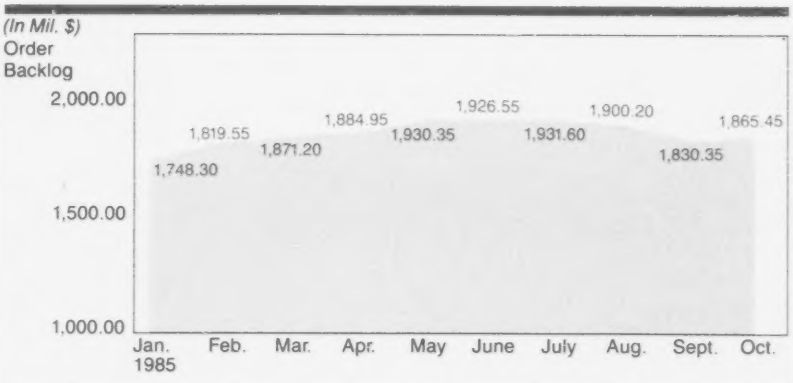
Machine Tool Orders Off 7 Pct

Reflecting fears by U.S. manufacturers that economic growth for the rest of this year and well into 1986 will be relatively weak, machine tool orders fell seven pct in September and are down 11 pct for the first three-quarters of this year, the National Machine Tool Builders' Association (NMTBA) said.

"We seem to be on another downslide after having struggled up to our previous recessionary lows," said NMTBA president James A. Gray. "Since June we have observed a steady decline in orders from $235 million to September's $172 million. We know the business investment dollars are there. We know that our products are competitive. And we know that American industry has the desire to buy capital equipment to modernize. What is missing is a vision of a growing future for manufacturing."

During September machine tool orders fell to $171.7 million compared with $184.5 million in August. Compared with September, 1984, orders in

MACHINE TOOL ORDERS
Backlog



the ninth month fell 40 pct. In August orders declined 8.3 pct compared with July.

Machine tool shipments during September rose 12 pct from their August level to a total value of $242.5 million. That shipment rate was 15 pct above the rate one year ago. The excess of shipments over orders resulted in a sharp, $71 million, decline in the industry's backlog of unfilled orders.

During September, orders for metalcutting type machine tools, which were 46 pct below last September's rate and declined 8 pct from their August level. Metalforming machine tools orders, off 21 pct from last year were off 5 pct from August.

Shipments of metalcutting type machine tools rose 21 pct during September to a rate that is 15 pct higher than it was one year ago; while metalforming shipments, which slid 5 pct during the month, reached a total that is 16 pct higher than it was one year ago.

"In 1981, President Reagan led us to a pro-expansion, pro-investment, pro-savings tax program that, once it took, led us out of the recession," said Mr. Gray. "Even the machine tool industry, always one of the last to recover, was showing signs of rejuvenation, as evidenced by the growth in shipments.

"Falling orders and backlogs are the clear result of the Congress' and Administration's protracted proposals and discussions of changes that would gut the salutary effects of the 1981 tax law. What began as an approach to developing a fair and simple tax code has turned into a dog-eat-dog battle for tax revenues at the expense of business, savings, investment and economic growth. As Congress debates, business investment plans languish, while capital purchases to create jobs, increase competitiveness and provide for future growth, are deferred." ***–Ed Bowers***

WEST

Rockwell Hit With Suspension On Government Work

The nation's second largest defense contractor was suspended in November from receiving new government contracts or renewing existing ones in a sign that the military is continuing to come down hard on its major suppliers.

Rockwell International, which is based in Pittsburgh but performs much of its high-visibility aerospace work in California was suspended for at least 30 days from receiving government contracts after company officials had pleaded guilty to 20 charges of false billings and had admitted overcharging the service.

The overcharging incident is more than three years old. It involves Collins Communications System, a Rockwell subsidiary based in Texas. In its investigation of the incident, the government claimed in court papers that six company employees took part in a plan to file phony time cards that covered work done on an automated data processing system used on the EC-135 airplane. The total contract was valued at $3.6 million.

In announcing the suspension at a Washington press conference, Air Force Secretary Verne Orr told reporters that he expected it to be temporary.

But he warned: "I'll keep it in effect until I'm sure that Rockwell has taken all steps necessary to safeguard against a recurrence."

Rockwell was given 30 days to come up with a remedial plan. The Air Force could then lift or extend the ban.

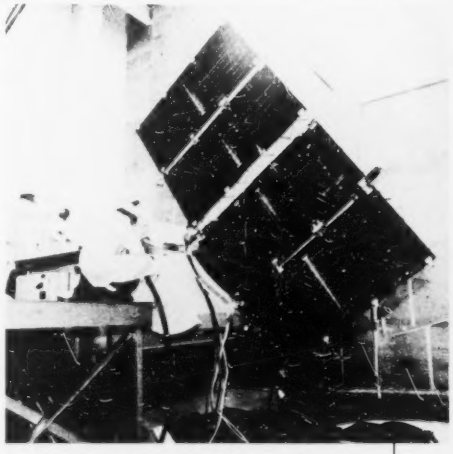
In a similar incident involving General Electric Co. earlier in 1985, the Air Force narrowed the ban involving new contracts to the specific company unit involved in the overcharging incident. In that case, GE admitted to overcharging the Air Force on costs associated with Minuteman missiles. Eventually the limited ban was lifted.

Even so, the announcement stirred the defense community, since it was obviously taken for wide public attention.

Mr. Orr went out of his way to tell reporters it was designed to "send a clear signal that the Air Force simply won't tolerate this or any other kinds of fraud regardless of the size of the contractor."

Rockwell is the nation's second largest defense contractor. Government sales totaled $6.2 billion during the 1984 fiscal year. Total company revenues were $11 billion.

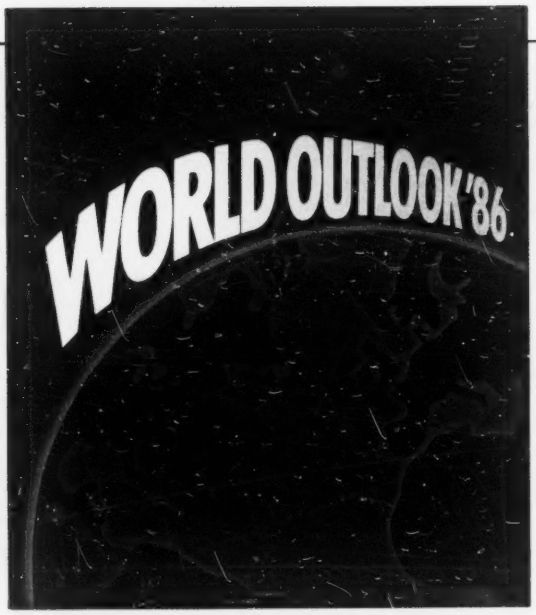
The company builds three status and highly visibile projects: the B-1 bomber, the space shuttle and the MX missile. It also manufactures Army missiles, the Navstar global positioning satellite and other expensive weaponry.



Global Positioning System 12, the first production satellite developed by Seal Beach's Satellite Systems Div., Rockwell International Corp., is designed to transform the sun's energy into electric power.

Company officials said little about the Air Force action, except to note that Mr. Orr said Rockwell "has fully cooperated with us and has been forthcoming in all aspects of the investigation."

The company issued a statement that noted, "We have been cooperating fully with the Air Force and will continue to do so. We look for an early resolution of this matter.



The driving force that has powered the world's economic engine into overdrive during the past few years is in need of a tune-up.

The United States, while keeping the global motor purring by importing a vast portion of its trading partners' exports, has, in the meantime, run up over a $100 billion trade deficit that is compromising its economic vitality.

The driving force will be out of service for awhile as repairs that began in 1985 continue throughout 1986. An alternative power source now must be found to keep the engine running at peak efficiency.

PRODUCTION'S 1986 world-wide survey of the leading industrialized nations indicates an upcoming period of slow growth for most countries, and stagnation for others. The declining value of the dollar, coupled with a growing protectionist movement are two key factors already slowing the volume of imports entering the U.S. Moreover, escalating pressure from Washington directed at U.S. trading partners to open up protected markets is realizing some success.

A Slowing On The

A PRODUCTION MAGAZINE STAFF REPORT

The U.S. is one of the three most important trading partners of each of the Pacific Basin nations, importing close to half of their annual exports. Because the U.S. can no longer absorb the wave of foreign products landing on its shores, the Pacific Basin countries will sputter this year and in the foreseeable future. They will have to regroup. Internal consumption will have to be increased and new markets must be sought in order to fill the void left by the U.S. as it attempts to harness its runaway trade deficit.

The European industrialized nations, on the whole, continue to show signs of recovery, and in some cases, slow growth rates following the stagnating effects of the world recession during the early 1980s. France, a technological powerhouse, for example, has yet to recover from the recession. To further compound matters, France—as well as the rest of Europe—must face the reality of increasing competition from Japan, and eventually South Korea, especially in the machine tool industry.

The Soviet-bloc countries that comprise the Council For Mutual Economic Assistance (Comecon) are showing signs of slow, steady improvement. Comecon is experimenting with policies that it hopes will improve its standing in the world market. Following November's U.S.-U.S.S.R. summit meeting in Geneva, political tensions have begun to ease which should open the door further for trade agreements between Comecon and the U.S.

Trend Horizon

United States

How long will the recovery last? That's the big question for U.S. manufacturers and for that matter the rest of the world.

Considerable uncertainty abounds in U.S. manufacturing circles.

Uncertainty about low interest rates and massive federal deficits. Uncertainty about continued consumer spending in the face of historically high consumer debt and uncertainty about federal monetary policy in the face of growing trade deficits, surging imports and a strong dollar. But most of all, uncertainty about historic recessionary/recovery cycles.

CAUTIOUS OPTIMISM APPEARS TO BE the primary sentiment of economists and corporate officials who have surveyed the 1986 economic landscape in the United States.

Few are predicting a major recession. Or for that matter, any major changes in the economy that was inherited from 1985. Many forsee the continuation of the recovery that began to assert itself in many corporate sectors early in 1984. But enough uncertainty abounds to make even the most confirmed optimist a bit skittish. Most officials are hedging their bets.

Uncertainty about low interest rates in the face of massive federal deficits. Uncertainty about continued consumer spending in the face of historically high consumer debt. Uncertainty about federal monetary policy in the face of growing trade deficits, surging imports and a stubbornly strong dollar. And most of all, uncertainty about historic recessionary/recovery cycles.

"We see a pattern of slow growth, but no recession," one Commerce Department economist explained. "Generally speaking, the economy is in a position where we have a very good outlook. The big negative is the foreign sector, where we are not competing effectively and giving up our market share."

What concerns many economists and corporate planners over the longer term is the general rule of thumb that postwar economic recoveries have traditionally lasted three years and have been followed by a recession.

Following this historic timetable, 1986 should mark the dawn of another cyclical economic downturn. But most believe this historic pattern won't be strictly followed. The last recession was actually a double-barreled affair that began in 1980, ended in 1981 and then returned with severity in mid-1981 and lingered for 18 months.

"That one was a lulu," one Commerce Department official explained. "It was deeper and longer than average. And that means it could be a long recovery."

As a result, many officials believe, the resulting recovery that began in 1982 may actually have another year or so to run before it peters out.

This view is bolstered by the fact that the traditional harbingers of an economic downturn, a buildup of inventory and high inflation, haven't yet appeared.

Nevertheless, there is general agreement that the economy could use a boost if the recovery is to continue. The National Machine Tool Builders' Association, in a business activity report released in late September, noted:

"The recovery is now in its 32nd month and, to maintain or expand its momentum, needs a new economic catalyst or release from the structural constraints. . .characterizing this upturn.

"Unfortunately, neither the Congressional deficit reduction package nor the proposed tax simplification program seems likely to provide such impetus."

The NMTBA report concluded: "In the final analysis the watchword is caution. . .Of particular concern is the lack of significant strength in those sectors of the economy that are still growing, and the likelihood of continued weakness in the many areas of the economy that are faced with stiff import competition."

Despite all the uncertainty, there is one, giant certainty in 1986: There will be an election come November.

And that has convinced many pragmatic executives and planners that even a worst case economic scenario will be pretty bearable because, no matter how bad things may get, they are not going to be allowed to get that bad, at least until after November.

And after that? Robert J. Eggert, president and chief economist of Eggert Economic Enterprises, which publishes the Arizona-based *Blue Chip Economic Indicators* newsletter, told the NMTBA annual convention that his consensus forsees the next recession beginning not until very late 1986 or early 1987.

"The latest Blue Chip consensus suggests that the green light for economic growth and stable inflation still prevails for the year ahead," Mr. Eggert said.

He predicted on the whole 1986 would end up being a good year, though not a great year.

Status Quo Outlook

Many industry officials seem to believe 1986 will allow many corporations to continue trimming, acquiring, merging or otherwise repositioning for the next period of economic gloom. In the interim, business actually looks pretty good, even in some of the industries that were torpedoed during the last downturn.

Take the computer software industry, which had its share of ups and downs in 1985.

Norman Block, the executive vice president and chief financial officer for California-based Ashton-Tate Corp., spoke words common to many industries this new year, at least from the executives who are speaking for the public record. Said Mr. Block: "Industry sales should be higher, but they will be growing at a slower rate. And we anticipate Ashton-Tate to outpace the industry rate."

Cautious optimism for your industry, strong enthusiasm for your company. That seems to be a general trend in the executive boardroom this year.

So, too, in the auto industry. L. R. Windecker, Ford Motor Company's research and analyst manager, forsees greater import penetration of the industry, a slight decline in U.S. car sales overall, but a pretty good year for Ford.

"Car sales in 1985 should wind up at about 10.8 million," said Mr. Windecker. In 1986 we expect them to be more than 10 million, but less than 10.5 million."

He believes that Ford will hold onto its overall share of the market, which has been hovering at slightly below 20 pct.

"Imports will increase in both volume and market share," he added. Additional foreign manufacturers are entering the American market at the same time more established foreign automakers are expanding their range of product offerings.

Imports, which captured approximately 27 pct of the market in 1985 should increase their share by an additional percent or two.

Booming Defense Industries

Actually, the amount of executive enthusiasm in 1986 appears to be directly proportional to a company's distance from Uncle Sam's lucrative contracts.

Officials in the defense and aerospace sector are more upbeat—jubilant might be the more accurate term—than their contemporaries slugging it out in decidedly less gentlemanly endeavors like steelmaking, shipbuilding, and other basic, heavy industries.

Aerospace and electronics have settled into a positive trajectory in 1986. There is no place to go but up in the Reagan Administration. Most major defense projects are firmly established, and 1986 orders are in the pipeline. Assuming the weapons work—and in a few well-publicized 1985 cases in which they didn't—these executives have little to worry about.

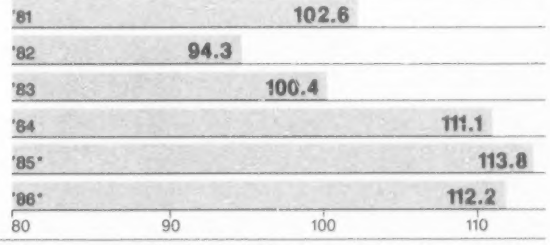
A company like St. Louis-based McDonnell Douglas Corp., has the best of both worlds. Commercial airplane sales at its Douglas Aircraft subsidiary in California are booming while government sales of missiles and combat aircraft are holding steady. Slumping

UNITED STATES

Gross National Product (GNP): $1.6 Trillion (1984)

	'81	'82	'83	'84	'85*	'86*
GNP *Trillion Dollars*	1.5	1.4	1.5	1.6	1.7	1.7
Foreign Trade *Billion Dollars*						
Imports	261	244	258	328	360	N/A
Exports	232	209	199	220	217	N/A
Trade Balance	– 28	– 35	– 59	– 108	– 143	– 150
Durable Goods Production *Billion Dollars*	1,006	920	1,019	1,182	1,200	N/A

Industrial Production Index-Mfg.
Base 1980 = 100



**Estimate, PRODUCTION Magazine* *N/A—Not Available*
Source: U.S. Department of Commerce

computer operations, with declining sales of hardware and software to business and institutional customers, is the only soft spot.

On the whole, new business, more expansion, and additional hirings are anticipated, at least at the Douglas subsidiary.

This is a far cry from the dark days of 1984 when the parent company scrapped a batch of new aircraft programs and cut the employment rolls. The doomsdayers thought Douglas might follow Lockheed right out of the commercial airplane business. Instead, 1986 should see Douglas employment grow from 20,500 to 24,000.

Fueling the growth are both commercial airplane sales and a new military project: The C-17 cargo plane. Douglas expects to deliver 105 new airplanes in 1986, mostly MD-80s, the popular new 165-seat passenger jet. Some 86 were delivered in 1985.

Orders for new commercial jets should increase, too, accenting a trend that took hold in 1985 when passenger airline loads increased, airline profits returned and the companies began purchasing jets to replace their aging fleets. Officials are busily marketing derivative versions of the MD-80, and are nearing a decision to launch a new MD-11 commercial jet program. The MD-11 is a derivative version of the DC-10 jumbo jet.

At the same time, Douglas expects increased military sales, especially for the $16 billion C-17 Air Force transport program. With initial production now scheduled for 1987 and approximately $380 million targeted for spending in 1986, company officials are optimistic.

"It's a damn bullish outlook," said David B. Eastman, manager of media relations. "We're just pushing at the gills right now."

The company is quadrupling manufacturing space for the C-17 this year, leasing 1 million sq. ft. of additional warehouse space and is considering constructing a new, eight-story 60,000 sq. ft. office building.

Seattle-based Boeing Co., which landed a $3.1 billion order from United Airlines for new commercial jets and a $2 billion order for aircraft from Northwest Orient at the end of last year, also expects its production lines to hum this year.

That will have a strong, positive ripple effect on the web of subcontractors and parts suppliers that comprise the supply pipeline for military and com-

mercial aviation.

California-based Lockheed Corp. which is concentrating on government contracts, is similarly optimistic about 1986.

"With the phasing out of our commercial airliner program, which is now completely finished, we are now virtually exclusively dealing in military aircraft programs," explained James W. Ragsdale, director of corporate public relations for Lockheed-California Co., a major subsidiary.

"Our hiring and planning for the future depends upon the level of military contracts we have, both from the U.S. government and our foreign customers. We think that in 1986 all the programs we have now will continue."

These include the Navy P-3 Orion and S-3 Viking antisubmarine warfare patrol plane and reconnaissance aircraft like the TR-1 and SR-71.

Employment at the Lockheed-California subsidiary, which stood at 17,200 at the end of 1985, is expected to increase by several hundred. Lockheed has been channeling more funds into research and development and plant facility expansion. Lockheed-California anticipates spending approximately $100 million in these areas in 1986.

The parent Lockheed Corp. plans to spend $5 billion between 1985 and 1990 on capital projects and company-sponsored research and development. These include construction of new research facilities at the Kelly Johnson Research Center north of Los Angeles and in Sunnyvale, where its missile and space operations are centered. That division landed a preliminary contract late last year that eventually could lead to a multi-billion dollar, five-year long "Star Wars" contract.

Lockheed, like Northrop, Hughes, Rockwell and TRW and other aerospace and electronic giants, is involved in sensitive government work on a potpourri of futuristic, multibillion dollar projects that range from the Star Wars missile defense system to the space shuttle, the Stealth bomber and the Advanced Tactical Fighter.

Many of these programs are in their initial development stages, and it's unclear which key players will wind up with a chunk of that super-secret project. The situation could become clearer by the end of 1986.

Outside the defense electronics area, economic prospects are a good deal less sanguine. Again, the ripple effect from the defense sector will compensate for weaker business segments, aiding major companies involved in both consumer and government related manufacturing.

Take Signal Companies of La Jolla, which merged into Allied-Signal Corp. in 1985 and has been consolidating its operations since. Officials predict major operations will benefit from defense spinoff business this year. The consumer oriented end of the business is less certain.

The Ampex electronics subsidiary has slumped from depressed sales in the personal computer segment of the high technology industry.

"The computer peripheral business has been pretty much on its ear," said Dan Derbes, executive vice president for Allied-Signal. "A lot of our customers have gone broke."

But Ampex also supplies professional audio and video equipment, and this business segment has been enjoying a moderately strong growth rate.

"We're pulling back on product introductions and battening down the hatches," said Mr. Derbes. "We don't see any big surge next year, but we also don't see any big downturn, at least through the first three quarters."

Signal's Garrett Corp. subsidiary in Los Angeles also forsees a skewered business situation next year. Its aerospace and commercial jet products should enjoy increased demand. But product demand for the general aviation and automobile markets should be flat.

"We should be up about 5 pct in real growth," said Mr. Derbes. "Employment will stay flat. Generally Allied-Signal is trying to consolidate, eliminate duplication and eliminate excess overhead costs. We're trying to reduce our staffing particularly in our administrative functions."

That cautious approach is mirrored throughout the high technology and manufacturing industries.

"We think 1986 should be a return to a "near-normal" year," said Richard O'Brien, corporate economist for Hewlett Packard Co.

"People are going to be cautious. We won't see a boom year like 1984, but we should see something that will look respectable."

Mr. O'Brien said 1985 marked a true recession for the electronics industry, despite the general economic upturn. Employment at H-P was stable, but in August the company began requiring employees to take two days off per month without pay. Shutdowns were ordered for Thanksgiving and Christmas holiday periods.

Mr. O'Brien believes the market won't further deteriorate in 1986. But he's unsure how much improvement there will be. "People are going to be cautious," he explained. "Things aren't getting any worse, but they aren't going to be getting any better."

H-P will again strive to avoid layoffs, but payless periods could reoccur. A hiring freeze is in effect. One sign of optimism: The firm is undertaking an aggressive college recruitment drive in 1986.

Restructuring

Restructuring and cautious optimism also predominate in the oil and gas industry. Officials at Los Angeles-based Atlantic Richfield Co. (ARCO) plan to turn their attention more to the discovery and production of oil and gas and less toward the downstream refining and marketing ends of the business. The company also will continue its ambitious restructuring effort begun in 1985.

"The sale of our non-coal minerals assets will be progressing in 1986," explained Al Baker, ARCO's manager of integrated planning. "The focus will be on oil and gas exploration and development, areas that we can handle more efficiently."

The outlook for the oil and gas industries, especially in the refining and marketing areas, appears uncertain.

"We expect there to be a continuation of the current oversupply situation," said Mr. Baker. "It is likely to extend through to the end of the 1980s."

Pacific Basin

The strength of the yen in 1986 should slow the rate of export growth for Japan.

In China, where the industrial sector has rolled along at a fever pitch a slowing trend should be in evidence as the government moves in to cool things down.

In Korea and Taiwan, two countries that rely on heavy export trade with the United States, there is cause for concern this year.

JAPAN

In the absence of government action to stimulate domestic demand, the Japanese economy will experience a major slowdown during 1986 as major export-oriented industries will feel the adverse effects of a greatly strengthened yen in relation to the U.S. dollar.

Manufacturing output, which grew 6.5 pct in the first six months of 1985, is still expected to exceed 5 pct for the full year. The current expansion of business activity, which dates back to 1983, is expected to peak by year-end, and most economists now feel productivity will increase by only 1 pct in 1986. Earlier estimates predicted 3 to 5 pct growth.

With the government committed to a program of fiscal reconstruction, it appears highly unlikely at this time that any major public works initiatives will be forthcoming. In part, because of this fiscal policy it is believed a slowdown could last for up to two years.

To a large extent the current situation stemmed from a September meeting of the "Group of Five" industrialized nations, which included the U.S. and Japan. The end result of that meeting was a commitment to drive down the value of the dollar in relation to other world currencies.

Prior to the announcement the dollar, in relation to the yen, stood at 240 yen. It subsequently has dropped to levels approaching 200 yen, as of November. The Bank of Japan earlier had indicated a target of 200 to 210 yen. There now are indications, however, the central bank may try to drive the dollar down to levels of as low as 190 yen.

The major effect of the weakened dollar is being felt by Japan's major export-oriented industries such as automobiles and electronics. The Japanese auto industry presently exports more than half of its annual production, of which 45 pct of total vehicle exports are shipped to the U.S.

The exchange losses are expected to be quite significant despite the fact that the industry—as well as Japan's highly charged electronics industry—remains fundamentally sound.

Hardest hit, however, will be industries such as shipbuilding which even prior to the sharp fluctuation in the exchange rate had begun to lose their international competitiveness.

Economists are suggesting that a rate of 200 yen to the dollar (from 225 yen) will bring about a 1.8 pct decline in the growth rate of Japan's real GNP. As a result, manufacturers already have begun to cut back on their planned spending for new plants and equipment. Capital investment by private sector firms is now expected to drop by 1 to 2 pct during the first quarter of 1986 compared with Jan.-March 1985.

Industries which may benefit from a stronger yen are utilities (electric power and gas), petrochemicals and petroleum. Gains, however, are likely to be offset somewhat by what is happening in other sectors. If, for instance, Japan goes into a recession, the demand for electricity invariably will decline.

CHINA

A country with close to one billion consumers admitting that it must increase its trade with the world market to stimulate industrial growth would appear to be the ideal trading partner. China is on the verge of becoming such a market.

Long content with remaining isolated from the world market, the country has announced a program of major economic reforms that include further opening its doors to stimulate trading ties with western industrialized countries.

From 1982-84 China's industry grew at a average rate of 10.6 pct compared to 7.1 pct for the period 1979-84. During the first six months of 1985 China recorded an overall industrial growth rate of 23 pct—a figure that China's leaders said must be reduced to a more "appropriate" growth rate level in the future. As adjustments are made during the latter part of 1985, the industrial growth rate should come in at around 12 pct.

China will release its Seventh, Five-Year-Plan later this month. And preliminary reports indicate a growth rate target of 7 pct in GDP, and a 12 pct increase in foreign trade. Considering the projected 1985 percentage, a more realistic growth rate for the next five years should hover around 10 pct.

Since 1981 the country has attained a trade surplus. The value of its trade in 1984 was close to $54 billion. Exports increased 17 pct to 27.4 billion, and imports 29 pct to 26.7 billion. Japan, Hong Kong, the U.S. and the European Economic Community are China's principal trading partners.

China's trade with the U.S. declined from a 1981 high of $5.5 billion to $5.2 billion in 1982 and $4.4 billion in 1983 due to a substantial reduction in U.S. agricultural sales stemming from China's decision to cut back imports because of both countries' failure to reach a new textile agreement.

Since 1982 one industry that has posted rapid growth is its machine tool industry. Machine tools accounted for more than 30 pct of the gross value of output. By the end of 1982, growth increased 15.9 pct and surged another 21.1 pct in 1983. The growth hinged on a strong demand for machinery in agriculture, energy, transportation and construction industries.

There are about 500 types of machines exported from China. Small hydropower generators are making inroads in the world market. In 1985, China exported more than $100 million worth of electronic equipment. The products included sophisticated electronic instruments, systems and technology which have replaced electronic parts and components.

Imports of machinery and equipment have also increased. In 1984 China

signed 150 contracts to import machinery equipment, 36 pct more than in 1983, representing $120 million. Major machine imports include: machine tools, forging presses, test equipment such as meters, test instruments and gauges, low energy consumption equipment, water pumps, air blowers, compressors, internal combustion engines and computer software. Imported technology has meant higher standards of Chinese machinery. During the Seventh Five Year Plan, more emphasis will be centered on importing manufacturing technology for energy exploration, general machinery and controls, automatic controls and testing equipment. China has indicated that any manufacturer who will transfer technology will be given preferential treatment.

China's surplus trade balance has decreased over the past two years and in 1985-1986 will show a slight deficit. China's planning agencies have called for faster growth in imports and a gradual expansion of the trade deficit. Trends established in 1983 indicate that China is increasing purchases of equipment and technology to meet short-term requirements and to support industrial growth to meet its long-term goals of modernazation and increased productivity. However, China's decline in its foreign exchange reserves has raised caution. The government recently moved to ban most import vehicles for two years to reduce the flood of Japanese cars entering the country. The government would rather see joint ventures with foreign companies.

Regarding imports, China's leadership is encouraging such businesses as machine tools, electronic components, iron and steel, and components to invest in state-of-the-art foreign technology, in addition to establishing joint ventures with foreign manufacturers.

China's steel industry imports more steel than any other country in the world aside from the U.S. China is the fourth largest steel producer in the world but it still must rely on imports to satisfy demand.

The country is currently in the midst of an extensive investment in its steel production program projected to reach an 80 million tons per year by the year 2000. To reach this goal, China will need to rely on foreign technology and equipment to modernize its existing facilities.

KOREA

The strength of the Korean economy closely mirrors its export trade to the United States, the predominant buyer of Korean manufactured goods. Because the U.S. trades heavily with Korea—as well as with all Pacific Basin countries—the last few years have witnessed substantial growth in Korea's economy relative to increased volume of exports to the U.S.

The U.S. is one of the three leading trading partners of every Pacific basin nation. The region has now surpassed Europe in importance in overall U.S. trade.

In the past, Korea sold approximately 30 pct of its exports to the U.S. In 1984 that figure grew to 35 pct, a sizable increase considering the U.S. is presently one of the few consistent markets in the world today. As more and more developing countries vie for a greater slice of the American market the increase in Korea's export percentage is noteworthy.

There is cause for concern. Korea fears that it will begin to lose its edge in trade with the U.S. because of competition from suppliers of similar products. A slow growth rate is expected in 1986 because of a saturation of exports into the U.S. market while the dollar remained high.

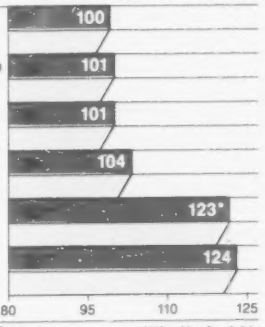
Another important factor relative to the general health of Korea's economy is the fact that the country's imports continually exceed exports, resulting in a continuance of its foreign trade debt. However, Korea does not view the debt as ominous because its long-term viability depends on foreign trade.

Since 1981, Korea's trade deficit has decreased from $4.9 billion in 1981 to about $300 million in 1985. At the end of 1986, Korea projects a slight surplus. One reason for the decreasing debt is Korea's movement into the manufacturing of high technology

JAPAN

Gross Domestic Product (GDP): $1.2 Trillion (1984)
Exchange Rate U.S. $1 = .005 Yen

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	100	105	110	120	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	143	132	126	138	123	193
Exports	152	138	147	169	176	133
Trade Balance	+9	+6	+21	+31	+53*	+60
Industrial Production Index - Mfg. *Base 1980 = 100*	100	101	101	104	123*	124

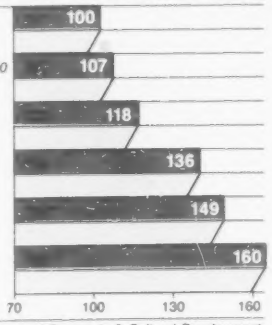


*Total Year **Projections N/A—Not Available
Source: U.S. Commerce Department

CHINA

Gross Domestic Product (GDP): $272 Billion (1984)
Exchange Rate U.S. $1 = $3.1 Yuan

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *U.S. Dollars*						
Imports	19.3	17.9	19.6	26.7	25.5**	N/A
Exports	21.5	22.9	23.5	27.4	24.4**	N/A
Trade Balance	+2.2	+5.0	+3.3	+0.7	−1.1	N/A
Industrial Production Index - Mfg. *Base 1980 = 100*	100	107	118	136	149	160

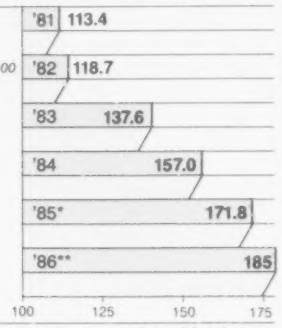


Source: Organization of Economic & Cultural Development
*Total Trade N/A—Not Available
**Projections

KOREA

Gross Domestic Product (GDP): $84 Billion (1985 Est.)
Exchange Rate U.S. $1 = 900 Won

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	26.1	24.2	26.1	30.6	29.2	32.0
Exports	21.2	21.8	24.4	29.2	29.0	32.0
Trade Balance	−4.9	−2.4	−1.7	−1.4	0.2	0.0

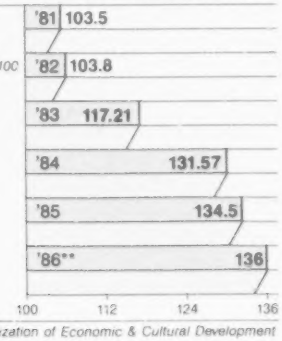


Source: Organization of Economic & Cultural Development
**Total Year* *N/A—Not Available*
***Projections*

TAIWAN

Gross Domestic Product (GDP): $65.9 Billion (1985 Est.)
Exchange Rate U.S. $1 = 39.0 Taiwanese Dollars

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	21.2	19.2	20.3	22.0	25.8	31.0
Exports	22.6	22.2	25.1	30.5	34.0	38.6
Trade Balance	+1.4	+3.0	+4.8	+8.5	+8.2	+7.6



Source: Organization of Economic & Cultural Development
**Total Year* *N/A—Not Available*
***Projections*

items such as electronics and machinery which are being exported. In addition, Korea exports about 30 pct of its annual steel production. Moreover, revenues from its emerging automobile industry are expected to make up for any trade loss in other manufacturing areas.

Regarding Korea's machinery production industry during the past few years, exports in 1981, for example, totaled 23 pct of total exports. Exports in 1984 totaled $829 million. In 1985, exports increased 30 pct to $1.07 billion. The forecast for 1986 is for machinery exports to total $1.3 billion. Major export items include automobiles, power generating machines and electrical machinery. On the other hand, machinery imports were up 4 pct over 1984 to $2.1 billion.

Because competition for a share of the U.S. market is on the upswing from emerging countries, Korea has plotted a course to focus its attention on the high-tech arena. Evidence of this shift can be observed in the country's production and exporting of machine tools, electronic equipment and automobiles.

In fact, Korea's move into the automobile industry is projected to be the leading export earner in the future. Later this year Korea will begin exporting its first of 100,000 subcompact cars to the U.S. In 1987, still more cars will land in the U.S. due to a cooperative agreement between General Motors Corp. and Daewoo Corp., Ltd. Already U.S. manufacturers have entered into contracts with Korean manufacturers for the production of such items as batteries and brake components.

The outlook for an increasing number of U.S. machine tool manufacturers in the Korean market is favorable since machine tools are listed for direct import status starting in 1986. Recently, Korea announced that it would lift import controls on 603 manufactured products and open up 102 industrial sectors to foreign investment over a three-year period beginning this year.

The further relaxing of Korean import controls is important considering Korea is on the verge of several major construction projects which include: a new international airport, two additional nuclear power plants, high-speed passenger and freight rail systems, and additional water and sewage treatment plants. A new steel plant is scheduled to open in 1987 that is expected to increase the country's total steel production by 2.7 million tons per year. Current output is about 13 million tons per year.

TAIWAN

Following Taiwan's robust economic activity in the early 1980s, 1986 appears to be the beginning of a period of very slow growth. Taiwan is in the early stage of its transformation from a manufacturer of textile products to a more highly-capitalized and technological-based industrial economy.

The significant expansion of exports has played a vital role in Taiwan's growth during the 1960s. From 1961 to 1971, exports increased 22 pct annually, and from 1971 to 1981, 19.2 pct. Taiwan's rapid growth was due to a prosperous world economy in the 1960s combined with its rapid transition from an agriculture-oriented to an industry-oriented economy.

During 1984, Taiwan focused on trading to the U.S. market, which imports about 50 pct of Taiwan's exports. Major exports include: electronic and electrical products, textiles, machinery, sporting goods and footwear. In 1983, electronic and electrical products surpassed textiles as Taiwan's leading export. Total exports in 1985 reached $34 billion and is projected to reach $38 billion in 1986. Taiwan's major imports include raw materials—especially oil from Japan—and industrial intermediates. Machinery purchases comprise about 25 pct of the country's imports.

Taiwan's export strength over the years has produced a massive trade surplus which registered a high of $8.5 billion in 1984 but has decreased to $8.2 billion in 1985 and is projected to drop to $7.6 billion in 1986. The 1985 gross domestic product (GDP) was $65 9 billion.

Trade between the U.S. and Taiwan continues to grow. Metalcutting machine tools imported from Taiwan dur-

ing the first six months of 1985 totaled $78.5 million, a 64 pct increase over the same period last year, according to statistics published by The National Machine Tool Builders Assn. (NMTBA).

AUSTRALIA

The Australian economy is slowly beginning to emerge from its worst recession since the postwar era of the late 1940s. Between 1972 and 1982, the country's economy grew at a 2.5 pct annual rate. The growth rate was just about half the rate it maintained during the 1950s and 1960s.

Australia's emergence from its decade-long slump is due to a number of factors.

Both state and federal budgets were expanded to include new housing construction and public works projects. Reductions of inventories during the recession are just now beginning to be restored. In addition, the 1983 devaluation of the dollar has spurred exports and kept imports at modest levels.

However, high interest rates coupled with concerns that the inflation rate could rise is holding private sector investments down.

Exports of coal and wheat during 1984-85 have been strong.

Australia is one of the world's leading exporters of energy resources, but, again, a global depression in the natural resources market has lowered profits. The production of minerals and energy products contributed 10 pct to the overal GDP and has been responsible for over 40 pct of total export earnings.

Australia has incurred a small deficit trade balance since 1981. Total trade during 1985 was $59.6 billion. Projections for 1986 estimate a $6 billion increase that should bring the deficit to zero balance.

Australia's machinery exports accounts for about 5 pct of total exports. Australia ranked 29th in world machine production and trade in 1984. Exports totaled $6.3 million while imports totaled $84.9 million. The United States exported $7.3 million worth of machine tools to Australia in 1984, down $7 million from 1983.

Western Europe

Look for West Germany to continue to lead the recovery.

Inflation is expected to remain at the lowest levels on the Continent while trade to the United States will push ahead steadily.

WEST GERMANY

West Germany currently is the main industrial power in Europe. It boasts steady if unspectacular growth and the lowest inflation rate—2.5 pct—in the world. Like the rest of Europe, it is concerned about how to cope with the challenges of Japan and the U.S. And like other developed countries it is perplexed by the seemingly intractable problem of unemployment—presently running at 9 pct.

After three years of stagnation, mechanical engineering recovered strongly in 1984. Orders are booming and production in 1985 is expected to be 3-5 pct above the 1984 figure. The forecast for 1986 is even better.

West Germany has been a phenomenal exporter during the post-war years. It has been the country's buoyant exports which have pulled the engineering sector out of the trough. This has been done in spite of the damaging metalworking strike in 1984 and industrial action in the printing industry.

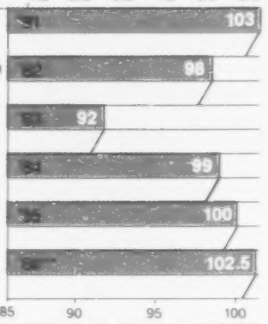
The strong dollar has helped West Germany's U.S. exports which rose a staggering 31 pct in 1984. This makes North America the biggest single customer for West German engineering products. The engineering sector was also helped in 1985 by strong investment in the domestic market.

An export drive in the machine tool field has reversed a trend of several years. An influx of machine tools by Japanese machine tool makers caused German builders to abandon 20,000 jobs in the industry between 1980 and 1984. Approximately thirty manufacturers were either swallowed up by bigger and more successful companies or

AUSTRALIA

Gross Domestic Product (GDP): $207 Billion (1985 Est.)
Exchange Rate U.S. $1 = .70 Australian dollar

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions Australian Dollars*						
Imports	20.2	22.9	21.6	27.0	30.1	32.5
Exports	18.4	20.4	21.6	25.7	29.5	32.5
Trade Balance	−1.8	−2.5	0.0	−1.3	−0.6	0.0
Industrial Production Index - Mfg. *Base 1980 = 100*	91	92	92	99	100	102.5

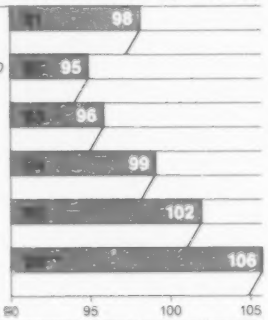


Source: Organization of Economic & Cultural Development
**Total Year* *N/A—Not Available*
***Projections*

WEST GERMANY

Gross Domestic Product (GDP): $683 Billion (1985 Est.)
Exchange Rate U.S. $1 = DM 2.6 (Oct. 1985)

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	105	110	113	117	119	121
Foreign Trade* *Billions DM*						
Imports	31	31	32	36	38	40
Exports	33	35	36	41	45	49
Trade Balance	+2	+4	+4	+5	+7	+9
Industrial Production Index - Mfg. *Base 1980 = 100*	91	95	96	99	102	106



Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*

disappeared altogether. The Japanese product input was particularly strong in CNC lathes and machining centers. German builders were shocked by the sophisticated electronics being incorporated into Japanese machines. A report—never made public—indicated to the Germans where and why the Japanese were making inroads. As a result many German machine tool builders are now concentrating on advanced electronically-equipped machines to combat foreign competition.

The government is now encouraging industry to use more CAD/CAM systems. General Electric Automation has recently opened a big automation center in Frankfurt with the purpose of selling advanced factory automation to industry. Siemens has also launched an ambitious 'megaproject' aimed at making one-megabit chips and, later, four-megabit chips. To speed the development and introduction of these, Siemens has turned to Toshiba for an agreement on knowhow.

In the automotive industry, the big news of the year was Daimler-Benz's takeover of the electrical giant AEG. This will form Germany's biggest industrial company with a turnover in the region of $22 billion. According to Daimler-Benz's chief executive, Dr Werner Breitschwerdt, the aim was to broaden the company's activities into new high-tech fields, particularly micro-technology. He noted that the group had already taken over MTU, the high-performance engine maker, earlier in the year and had also taken a majority interest in Dornier, the aerospace concern. These two acquisitions are believed to have cost the company $384 million and mirror GM's recent aquisition policy in the U.S.

The automotive industry in general has had a troubled time in the last year or two. First, there was the unprecedented metalworkers' strike in 1984, which hit the automotive industry hard, mainly through stopping the flow of components to carmakers. Second, the uncertainty over emissions regulations —caused ironically by the German government's desire to appease its Greenpeace movement—created havoc within the German domestic market.

Both issues have now been settled and companies like Daimler-Benz, VW and BMW will no doubt continue on their path of introducing high automation to combat soaring wage costs. VW is riding high at the moment and is believed to have jumped to the top of the car sales league at mid-1980.

UNITED KINGDOM

The United Kingdom has been improving its competitive position slowly over the last five years against a background of concerns about unemployment, the decline of the manufacturing base and a possible falloff of North Sea oil. Industrial production is recovering from the effects of the debilitating mine strike which occurred in 1984. The latest figures, suggest that in the second quarter of 1985 manufacturing output is running at 2.5 pct above the equivalent figure a year earlier.

The forecast for 1985 is positive with an underlying growth in the area of 2.5-3.0 pct. Whether this can be carried forward to 1986, however, is a dilemma since the U.K. relies heavily on continued consumer spending.

An encouraging sign is the high rate of industrial investment in 1984-85 of 15 pct in real terms. This was pushed higher, however, by the announcement in the 1984 budget that initial tax allowances on industrial buildings and plants were to be phased out. This prompted many companies to announce investment schemes.

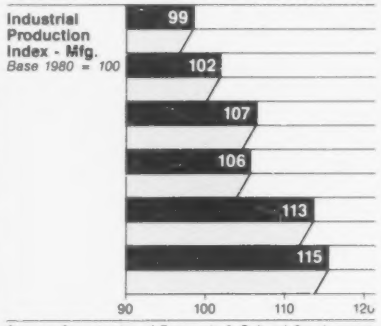
The investment of most manufacturers has followed an expected pattern. Plant and machinery—on which the first year allowance has been cut from 75-50 pct—was the fastest growing category at 19 pct in 1984. In the first quarter of 1985 plant investment was up 28 pct over a similar period in the previous year. The other area where there was a healthy investment was in new vehicles for industry, which posted a figure of 27 pct in the first quarter compared with the previous year. Most of the investment was targeted in heavy vehicles rather than cars or vans.

On the basis of past experience, the investment boom could be expected to

UNITED KINGDOM

Gross Domestic Product (GDP): $472 Billion (1985 Est.)
Exchange Rate U.S. $1.41 = 1 pound (Oct. 1985)

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	113	125	137	149	157	162
Foreign Trade* *Billions Pounds*						
Imports	4.2	4.7	5.5	6.5	7.1	8.0
Exports	4.2	4.6	5.0	5.8	6.7	7.1
Trade Balance	0	−0.1	−0.5	−0.7	−0.4	−0.9

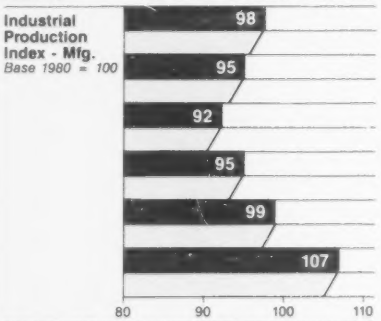


Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

ITALY

Gross Domestic Product (GDP): $368 Billion (1985 Est.)
Exchange Rate U.S. $1 = 1,774 Lire

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	123	144	172	192	210	217
Foreign Trade* *Billions Lire*						
Imports	8,639	9,684	10,167	12,349	14,824	15,937
Exports	7,170	8,271	9,211	10,752	12,074	13,034
Trade Balance	−1469	−1413	−956	−1597	−2750	−2903



Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*

produce good growth in mechanical engineering output. The fact that it hasn't is due to the development of new technology. Put simply, hardware is being replaced by software as industry invests in new manufacturing technology. Much of the capital investment has been diverted away from mechanical to electrical and electronic engineering.

Although there has been a recovery in the British machine tool market of nearly 11 pct in 1984, output is still 40 pct below 1977.

A recent report on the British machine tool industry predicts that imports of machine tools are likely to rise at a faster rate than the increase in production or exports. The market for machinery is expected to grow by 6 pct in real terms to about $1 billion, with imports—accounting for over 60 pct of the market—rising 6.5 pct to $650 million.

The report expects machine tool exports to grow by 3.5 pct to $670 million, though several builders report soaring sales to the U.S. market. U.K. machine tool production should grow by 4 pct to $1.040 billion in 1985 to $1.128 billion by 1989.

By this time, notes *PRS Business Publications*, which produced the report, about 70 pct of the UK demand for metal-cutting and metal-forming machines will be accounted for by NC machines.

Although historically British productivity has been low, it has improved dramatically in recent years with the impact of new technology. The figures show that wage costs per unit of output are rising much more slowly than actual wages.

A noticeable trend over the last two years is for U.S. companies to seek a manufacturing base in the U.K. and the latest example of this, announced in late October, concerns J. I. Case, the U.S. farm and construction machinery maker. The American company is to spend $126 million to transfer a large part of its U.S. manufacturing to Britain. This will reinforce Great Britain's position as the largest tractor maker in the Western world, and could lead to additional exports amounting to $182 million a year by 1990.

ITALY

Italy's emergence from recession took place later than most other countries and is now well underway. In 1984, gross domestic product (GDP) increased by 2.6 pct in real terms, and is expected to be about the same level in 1985. Contrary to previous experience, this has not caused a higher inflation rate. Inflation is currently just over 10 pct, higher than the European average, but below the 15 pct of 1983.

Italy's current major problem is the trade deficit caused by a sharp rise in imports. It was because of this factor that the government devalued the Lira by 8 pct in mid-year.

The more cyclically-sensitive industrial sector has kept pace with the general upswing in the economy although it has tended to expand and contract sharply with manufacturers responding quickly to the swings in demand. The recovery was posted in chemicals, paper, wood and furniture, textiles and metalworking. Capacity utilization in industry increased from 70 to 72 pct in 1983-84, but in the first half of 1985 was still below the pre-recession peak.

An intense rationalization of production is occurring, pushed by the automotive industry. The Italian automobile sector was one of the first users of robots and advanced automation, aimed mainly at counteracting the chronic labor problems of the 1960s and 1970s.

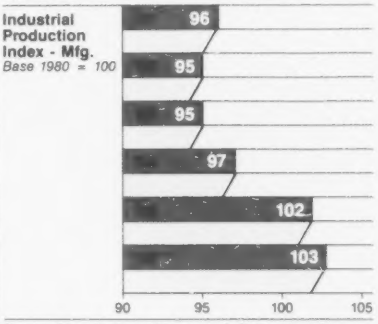
Fiat, via its machine tool arm, Comau, based in Turin, has pioneered automatic assembly. Manufacturer of the Strada cylinder head was completely automated several years ago. Last year, Fiat expanded its Termoli engine plant on the country's Adriatic coast and installed what is claimed to be the most advanced automatic assembly plant in the world. At Termoli, the FIRE 1000 power unit for a whole range of Fiat cars is assembled entirely by a combination of robots and advanced automation.

In the machine tool market, Italy has established a strong position for itself. It ranks as the fifth largest producer in the world with annual sales of roughly $1 billion. The industry sells 20 pct of its total production for export.

FRANCE

Gross Domestic Product (GDP): $490 Billion (1984)
Exchange Rate U.S. $1 = 8.1 French Francs (Oct. 1985)

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	112	130	145	156	165	171
Foreign Trade* *Billions French Francs*						
Imports	52	60	64	73	79	85
Exports	48	53	60	71	78	82
Trade Balance	−4	−7	−4	−2	−1	−3



Source: Organization of Economic & Cultural Development
**Total Trade*
***Projections*

Like most other European machine tool industries, Italy is alarmed at the rising Japanese competition. There also is concern at the possibility of U.S. protectionism.

Another concern is the lapse of an Italian law which in effect provided a valuable subsidy for domestic builders. This was a grant aimed at encouraging plant modernisation and provided up to 25 pct of the purchase of a new machine tool. More help is needed at the present time, said a spokesman, not less. He also noted that the Japanese manufacturing industry receives massive government help in technology and automation.

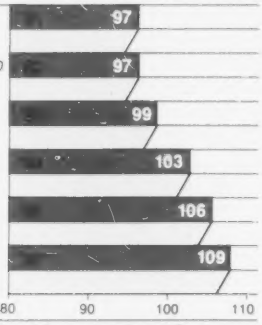
The worry about U.S. protectionism has as its background the fact that the Italian machine tool industry in 1984 shipped some 10 pct of its exports to North America valued at $52 million.

Comau is currently contracted to supply GM plants in the U.S. and Canada with highly-automated assembly lines for aluminium cylinder heads. This will involve about 50 large metal-cutting machines and more than 200 robots.

BELGIUM

Gross Domestic Product (GDP): $85 Billion (1984)
Exchange Rate U.S. $1 = 53 Belgium Francs

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	109	117	124	130	132	N/A
Foreign Trade* *Billions Belgium Francs*						
Imports	192	221	235	266	266	275
Exports	171	199	220	248	261	275
Trade Balance	−21	−22	−15	−18	−5	0



Source: Organization of Economic & Cultural Development
**Total Trade*
***Projections*
N/A—Not Available

FRANCE

In the post-war years, France transformed itself from primarily an agricultural country to a technological power. In doing so, it enjoyed a phenomenally high rate of growth. Today, it is a world leader in nuclear engineering and a major factor in aerospace, armament and automotive production.

Over the last year or two, however, things have gone sour for France. Although at no time in the last decade has GDP actually decreased, the French economy entered a period of stagnation in the early eighties from which it has not yet recovered.

In 1984, real gross domestic product (GDP) improved by about 1.5 pct supported by relatively buoyant world trading conditions. In 1985, however, growth looks like it is being restricted to 1 pct as international trade slows.

This year is an election year in France and therefore economic policy could get pushed to one side as the political parties manuever for position.

A considerable amount of government-sponsored industrial restructuring has gone ahead in France in recent years, not the least in machine tools. Two state-supported companies, Machines Francaises Lourdes (MFL) and Intelautomatisme, have acted as focal points for rationalization in the machine tool field.

MFL, a specialist manufacturer in heavy machine tools, owned by the state Industrial Development Institute (IDI) and several mainly state-owned industrial groups, is putting its money on a major export drive.

An international sales network has been put in place and MFL chairman, Louis Trady, noted that the current order book guarantees sales of around $62 million in 1985. Orders in mid-1985 were received from General Electric and Westinghouse in the United States and the United Kingdom's Austin Rover Group. Overall, French machine tool orders in the first nine months of 1985 rose by 24 pct compared with the same period of 1983.

Domestic machine tool sales, heavily depressed in 1983, grew by 34 pct in 1984 and exports by 7 pct. More than half the orders were for numerically-controlled equipment.

Like other European machine tool industries, the French are worried about Japanese competition. French officials admit that the government is encouraging Japanese participation in the industry as a means of stimulating domestic companies to boost efficiency.

BELGIUM

After thirty months of virtual stability industrial output picked up strongly in late 1983 and in that year averaged 2 pct growth against a decline the year before. This was the first sign that government policies were impacting the economic neglect of the 1970s when the balance of payments posted deficits year after year.

Observers noted that companies were being under-capitalized. The result was that they were being pushed out of foreign markets. This was particularly serious since 70 pct of GDP is tied to overseas trade.

Foreign trade statistics indicate that from 1981, the foreign trade gap has been cut from nearly $0.5 billion to an estimated breakeven point next year.

One of the main concerns is rising wage costs. In the manufacturing sector, wages have increased more than 30 pct in five years, and in particular against Belgium's main trading partner, Germany. According to Fabrimetal, the industry's competitive position has decreased 9 to 10 pct in the recent past.

The primary problem is inflation. Belgium's inflation rate has been moving ahead at 5.3 pct. Employers complain that the trouble is government-imposed social program costs which are increasing faster than wages. Another common complaint of the business community is that the government's official spending is too high. Certainly, the size of the public deficit has continued to rise in absolute terms over the past few years. It is fortunate that as a proportion of GDP it has started to fall.

The government's target is to reduce the public deficit—currently running at 10 pct of GDP—down to 7 pct by 1987.

NETHERLANDS

Over the past three decades, the development of the Euroports of Amsterdam and Rotterdam have brought the Netherlands unprecedented wealth. A large part of Europe's products now flow through these two main gateways to Europe.

The Dutch economy started to improve in 1983 after the global recession and recovery continued through 1984. The country has a low rate of inflation of 3.2 pct and is one of the few countries with a positive trade balance.

Real GDP is expected to grow by 2 pct in 1985 and manufacturing production is on a marked upward trend—especially metal processing.

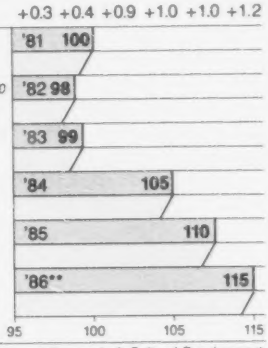
Imports of investment goods, raw materials and semi-manufactured goods (together more than 60 pct of total imports) have risen sharply in recent years. However, export volume posted an even stronger growth and continued into 1985.

The Netherlands competitive position in the world market has been helped by moderate wage increases as well as by the strong U.S. dollar.

NETHERLANDS

Gross Domestic Product (GDP): $137 Billion (1984)
Exchange Rate U.S. $1 = 2.9 Guilders

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	103	110	113	114	119	120
Foreign Trade* *Billions Guilders*						
Imports	13.9	14.3	14.4	16.5	18.0	18.2
Exports	14.2	14.7	15.3	17.5	19.0	19.4
Trade Balance	+0.3	+0.4	+0.9	+1.0	+1.0	+1.2

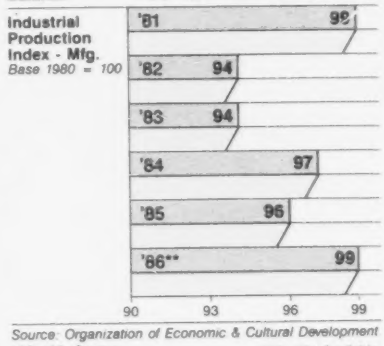


Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*

SWITZERLAND

Gross Domestic Product (GDP): $100 Billion (1984)
Exchange Rate U.S. $1 = 2.1 Swiss Francs

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions Swiss Francs*						
Imports	6.0	4.8	5.1	5.7	6.3	7.0
Exports	4.4	4.4	4.5	5.1	5.6	5.9
Trade Balance	−0.6	−0.4	−0.6	−0.6	−0.7	−1.1

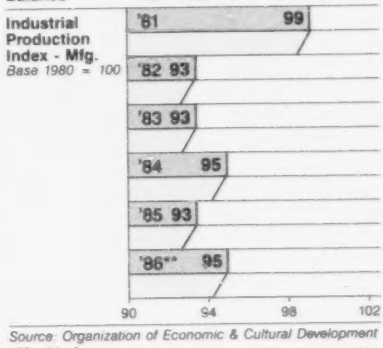


Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

GREECE

Gross Domestic Product (GDP): $41 Billion (1984)
Exchange Rate U.S. $1 = 156 Drachma

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	127	170	203	256	272	282
Foreign Trade* *Billions Drachma*						
Imports	N/A	10.1	9.5	9.8	N/A	N/A
Exports	N/A	4.1	4.1	4.4	N/A	N/A
Trade Balance	N/A	−6.3	−5.4	−5.4	N/A	N/A



Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

The Netherlands has a small but growing automotive industry of which the heavy truck builder, DAF, is an essential part. The main stimuli to this sector, however, will be in 1986 when a new small Volvo, which is built in Holland, is due to come on the market.

Few details of this project are available. It is known however that a new plant has been constructed that will use the latest in car manufacturing technology.

SWITZERLAND

Although Switzerland is better known in the world for its banking and financial services, it is nevertheless a leading engineering country with a bigger share of the world's machine tool market than either France or the United Kingdom. As a machine tool exporter, it ranks second in Europe behind West Germany.

Because of the country's high dependence on exports, it was hit hard by the world recession of the early 1980s and is only now pulling out of it.

Industrial production improved appreciably in 1984 over the previous year and the initial months of 1985 were again boosted by a weakening of the Swiss Franc on international exchange markets.

In mechanical engineering and the metals industry (which account for 50 pct of Switzerland's industrial exports) there were positive signs of growth in the second quarter of 1985, but a pronounced decline in activity cannot be ruled out.

Despite the improvement in exports, the country is still running a hefty trade deficit which, when 1985 figures are complete; is expected to rise to nearly 9 billion Swiss Francs. Fortunately, Switzerland has a healthy invisible trade comprised mainly of tourism and financial services. This should bring the current account surplus to something slightly less than the 7.5 billion Swiss Francs recorded in 1984.

GREECE

The economy in Greece remains more dependent on agriculture than the EEC as a whole. OECD figures show that in 1982 the proportions of GDP contributed by agriculture and industry in Greece were 16.5 and 25.4 pct respectively. Equivalent figures for the EEC are 3.6 and 36 pct. The manufacturing sector is one of the smallest in Europe and has been relatively dormant over the past six years.

The inflation rate has continued to decline, but only gradually. After averaging 21 pct in 1982 and 20.3 pct in 1983, inflation fell to 18.1 pct in December 1984. In the meantime, wages have been rising sharply.

Currently, discussions are proceeding with the EEC on a $2 billion EEC loan to help solve the country's balance of payments crisis. The government has applied to the EEC for a one-year extension on the January 1987 deadline for introducing a Value Added Tax (VAT). Athens also wants to continue restricting the movement of capital.

Over the short term, the outlook is not very encouraging. Critical problems are the need to solve the balance of payments situation, encourage more private investment in industry and reduce inflation.

SPAIN

A policy of rapid industrialization is being pursued in Spain. It has meant restructuring the economy by reducing its dependence on imported energy, and modernizing outdated industries.

Since 1982 the socialist government has pursued tight fiscal and monetary policies. The purpose has been to reduce inflation and curtail deficits in the public sector.

A sizeable trade gap has occurred in spite of a huge increase in exports over the past five years. This has occurred mainly because of corresponding increases in imported goods. Both imports and exports have more than doubled since 1981.

By international standards, productivity and wage costs are low. But wages are rising sharply.

In the strategic sectors of shipbuilding and steelmaking, cuts of around 40 pct have been typical. And in domestic appliance manufacture layoffs have been even more stringent.

Auto building has increased at a rapid pace in importance in the last decade, beginning significantly with Ford's decision to build a major plant at the village of Almusafes on the Mediterranean coast. In 1984, Spain built 1.2 million cars and more than 147,000 farm and industrial vehicles.

The country has become an important automotive exporter, mainly to the already-crowded European market. Apart from Ford, GM has a number of large advanced-technology automotive plants in Spain—as do Citroen, Peugeot, Reanult and Nissan. The national car builder, Seat, is in the process of being acquired by Germany's VW and is making a determined effort to increase its exports.

Spain is a sizeable builder of machine tools. Output in 1984 amounted to nearly $250 million, of which over half were exported. Most exports went to West Germany, France and Great Britain.

A continued gradual acceleration of the economy is expected during 1986. Inflation should level off under the influence of wage moderation and an easing of import prices.

PORTUGAL

Like Spain, Portugal is busy clearing the decks preparing for its entry into the Common Market. In 1984, the government did a good job of reducing the drain of foreign exchange on current account, which proved to be a problem in 1983. However, the trade gap forecast for 1985 is about $2.5 billion, so the position could slip again.

Manufacturing accounts for 40 pct of GDP, more than 66 pct of exports and employs 25 pct of the labor force. However, 50 pct of this manufacturing base is in shoes and leathergoods, textiles, woodworking, cork and ceramics. The only large-scale heavy industry is shipbuilding and repair.

Modernization of industry is being sought over a three- to four-year period in preparation for full integration into the EEC. The idea is to maximize its indigenous natural resources.

Venture capital is to be made freely available to encourage new enterprises. The atmosphere is ripe for incoming manufacturing investment.

There has been some investment already. Portugal's first fully-automated robotized plant which produces small electric motors for sewing machines opened in the town of Ovar in May 1985. The Belgian company, ACEC, holds a 65 pct interest though all the capital was raised in Portugal.

Some 20 electronics companies, many recently established, operate in Portugal. Seventy eight percent of the $470 million invested in 1984 in the manufacturing sector was foreign capital.

As the country inches into the EEC, many U.S. and Far Eastern countries are eyeing Portugal as a possible springboard into the lucrative European market.

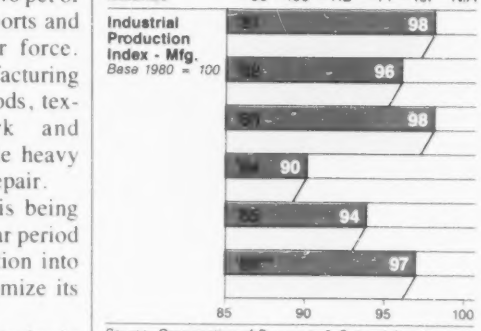
Portugal's industrial production index has increased very slowly during the past five years. The country has also incurred a negative trade balance during that same period. Projections call for a $2.5 billion deficit trade balance at the end of 1985.

In 1984 Portugal ranked 35th among leading countries in machine tool production and trade.

SPAIN

Gross Domestic Product (GDP): $155 Billion (1984)
Exchange Rate U.S. $1 = 160 Pesetas

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	122	142	163	182	207	217
Foreign Trade* *Billions Pesetas*						
Imports	247	288	348	385	439	N/A
Exports	157	188	236	314	332	N/A
Trade Balance	-90	-100	-112	-71	-107	N/A
Industrial Production Index - Mfg. *Base 1980 = 100*	98	96	98	90	94	97

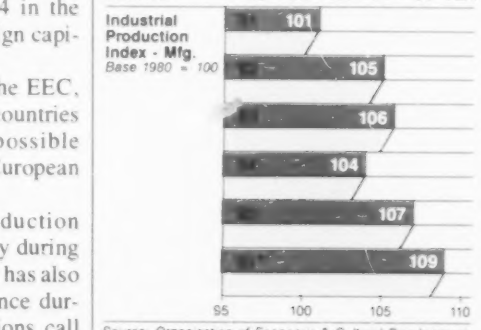


Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

PORTUGAL

Gross Domestic Product (GDP): $25 Billion (1984)
Exchange Rate U.S. $1 = 162 Escudos

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	121	143	169	199	198	198
Foreign Trade* *Billions Escudos*						
Imports	51	63	74	84	101	N/A
Exports	21	28	42	63	65	N/A
Trade Balance	-30	-35	-32	-21	-36	N/A
Industrial Production Index - Mfg. *Base 1980 = 100*	101	105	106	104	107	109



Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

Eastern Europe

In the Soviet Union the economic fortunes of the country will be built on the success of the country's Five-Year Plan. Under the new Soviet Premier, industrial productivity, better technology and plant modernization will be emphasized throughout the manufacturing sector.

COMECON

The Soviet-bloc countries that compose the Council For Mutual Economic Assistance (Comecon) are basically in an experimental stage regarding policies directed towards competition in the world market.

What Comecon wants most from the West is high-tech products. But trade embargoes limit the range of many high-tech items that can be sold to Soviet-bloc countries. However, some U.S. companies are examining the potential of interfacing Western machine tools and systems with Eastern-bloc computers and software.

The Soviet Union has hard currency reserves of $10 to $11 billion. A decrease in political tensions between East and West could result in better trading prospects.

Often overlooked by the West is the fact that Comecon countries also have advanced technology to offer in trade. For example, the Soviet Union has developed metallurgical processes and the GDR and Czechoslovakia have had FMS for the past ten years.

There is evidence that trade between Comecon and the U.S. is expanding. Comecon's exports to the U.S. rose substantially in the first five months of 1985 compared to the same period in 1984, from $629 million to $726 million. And U.S. exports to the Soviet Union increased $1.5 billion during that same period with agricultural produts accounting for $1.3 billion of the total.

Poland, however, remains the largest market for U.S. products. Hungary, Czechoslovakia, Romania and Bulgaria have begun to increase trade with the U.S.

U.S.S.R.

The five-year plan from 1986-1990 will require an increase in national income of greater than 4 pct per year. The plan calls for wide changes in the organization of industrial equipment buying policy and management responsibility.

In addition, trade patterns are changing. Exports are declining to the West and the developing countries. New markets for Soviet industrial products may open up following the signing of a five-year trade pact by the Chinese Vice Premier, Yao Yilin with the Soviet Union for the period 1986-1990. Talks are underway between the U.S. and the Soviets with the aim of granting the Soviet Union "most-favored-nation" status. These talks, by U.S. Commerce Secretary Malcolm Baldridge and Soviet foreign trade minister Nikolai Patolichev, could result in increased exports of U.S.-built oil and gas equipment to the country.

In October, 1985, Soviet Premier Gorbachev introduced the new five-year plan to the central committee of the Soviet communist party. It pointed to a 3 pct annual growth rate in light industry and a 7 pct annual growth in services. Mr. Gorbachev emphasized higher productivity, better technology and plant reorganization.

The Soviet Union will not be offering any major contracts to Western suppliers, other than steel plant modernization proposals and, possibly, an automotive engine production technology contract with a Japanese company. The trend will be towards smaller, individual company contracts—one or two machine tools with parts-handling equipment. Soviet management decision-making is changing too. Decision-making is being delegated to lower management levels while factories are being re-organized on a more competitive "price-for-quality" basis.

A potentially-exciting modernization area to Western production equipment and machine-tool suppliers, will be the Soviet truck industry. The GAZ plant is planning a new series of heavy-duty trucks. They want robotization and FMS. All the Soviet truck plants, including ZIL, GAZ, Belorus, Kremenchug and Kamsk, plan moderization and increased output. These plants are looking to the EEC suppliers and Japan (not the U.S. at present) for the latest in production technology. Orders are being placed on a "part contract" basis, machine-tool-by-machine-tool. The overall value will be enormous.

For the Soviet auto industry, Nissan Motor, Japan, is considering a Soviet request to buy the latest Japanese automotive manufacturing technology. The country wants to produce 1500-1600 cc engines at a rate of 100,000-200,000 per year.

Other sectors seeking to modernize are the Soviet agricultural machinery, food processing machinery and energy machinery builders. There could be lucrative contracts in these industries. In iron and steel, Finsider of Italy has picked up three major contracts. Voest-Alpine of Austria is also doing well.

In 1984, Soviet trade with the West rose 6.4 pct while turnover with the U.S. rose 64.7 pct to 3.13 billion Rubles. Japanese trade declined 3.53 pct to 2.89 billion Rubles. West Germany, which stands to do very well in machine-tool and production equipment exports to the country increased its trade with the Soviets by 7.1 pct to 7.5 billion Rubles. Soviet trade also rose with France, Italy, Britain, the Netherlands and Canada.

Increased Soviet sales of natural gas to Western Europe is the main factor behind trade expansion. Western trade accounted for 29.3 pct of total Soviet trade volume in 1984.

In early 1985, exports to non-socialist countries declined 30.7 pct in dollars. Imports declined 4.7 pct. Exports to the developed West declined 36.3 pct in nominal dollar terms in the first quarter of 1985. The decline in energy exports was 42 pct. Soviet imports from the West in the same period declined 2.3 pct (excluding grain

deals). Exports to the developing countries fell 19.8 pct and imports fell 11 pct in the first quarter of 1985. The Soviet trade surplus with these countries fell 47 pct when compared with the first quarter of 1984.

Exports to the socialist countries was stymied. However, the indicators for the second quarter, 1985, show some growth of trade in most sectors.

GERMAN DEMOCRATIC REPUBLIC (GDR)

The German Democratic Republic (GDR) possesses few natural resources. Its economy is based on importing raw materials which are then processed into manufactured products.

At the beginning of the 1980s, the GDR set a goal to increase its export trade and limit imports to erase its trade deficits and mounting foreign debt. The policy shift stemmed from the GDR's heavy dependence on Western imports in order to spur economic growth during the 1970s. In 1982 the effect of the policy change resulted in the GDR incurring a trade surplus, its first in many years.

However, the reform measures slowed investments resulting in few goods available for domestic consumption, and put on hold the government's plan to modernize plants and equipment.

In 1984, the GDR recognized that economic growth was reaching a peak, and that major investments in industrial plants were needed causing—many analysts believe—the GDR's accelerated borrowing of hard currency in 1985.

The GDR's current Five-Year Plan (1986-1990) emphasizes industrial modernization and growth in high technology. As recently as eight years ago the GDR had no microelectronic industry. Today, the GDR claims to be almost self-sufficient, having developed production techniques for making chips and components including CNC, DNC, and CAD/CAM systems.

The GDR intends to automate 40 to 50 pct of its mechanical engineering plants, making wider use of FMS, automatic assembly and CAE systems. Net-shape forming technology will be used more to save materials.

During 1984 the GDR invested $307 million in machine tool research and development. In 1985 that figure jumped to $340 million. A $2.9 billion investment is planned between 1986 and 1990.

The construction and chemical industries will also be modernized. Some $230 billion is available for the construction industry between 1986 and 1990. Some of this new technology will be imported from the West, principally, West Germany.

In 1984, the GDR's economy grew by 5.5 pct, the highest per capita income among Comecon countries. Industrial growth stemmed mainly from electrical engineering, electronics and equipment production. Output in these sectors was up 8 pct in 1984 compared to 1983.

About 30 pct of the GDR's national income comes from foreign trade. The Soviet Union is its main trading partner accounting for 40 pct of all exports and imports. Soviet exports to the GDR consist mostly of fuels (particularly oil). Nearly two-thirds of the GDR's exports go to the Soviet Union with machinery and equipment leading the list.

In order to accomplish its goals established in the Five-Year Plan, the GDR will require micro electronics, computer and automation technology, and robot and sensor technology.

BULGARIA

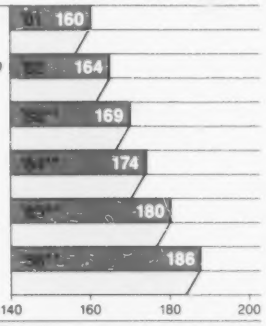
After sluggish growth in 1983, the Bulgarian economy grew 4.6 pct in 1984 only to see 1985 get off to a slow start due to a severe winter, attaining only a 2.4 pct rate of increase for the first six months.

Main industrial growth is in mechanical and electrical engineering, metalworking and energy sales. Above-average growth is reported by manufacturers of industrial robots and manipulators, machine tools, railroad freight

U.S.S.R.

Gross Domestic Product (GDP): $1.6 Trillion (1983 Est.)
Exchange Rate U.S. $1 = .78 Ruble

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	25.1	26.3	31.5	33.5	35.5	38.5
Exports	23.9	26.1	27.0	27.5	30.5	34.5
Trade Balance	−1.2	−0.2	−4.5	−8.0	−5.0	−4.0
Industrial Production Index - Mfg. *Base 1970 = 100*	160	164	169	174	180	186

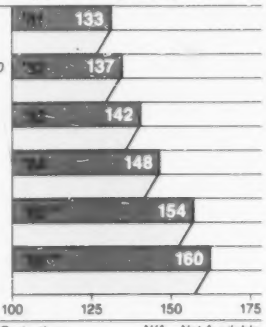


*Total Year **Projections N/A—Not Available
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service

German Democratic Republic (GDR)

Gross Domestic Product (GDP): $150 Billion (1984 Est.)
Exchange Rate U.S. $1 = .39 Mark

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	5.9	5.0	6.0	7.9	9.7	11.1
Exports	5.4	6.0	5.9	6.6	7.7	8.5
Trade Balance	−0.5	+1.0	−0.1	−1.3	−2.0	−2.6
Industrial Production Index - Mfg. *Base 1970 = 100*	133	137	142	148	154	160

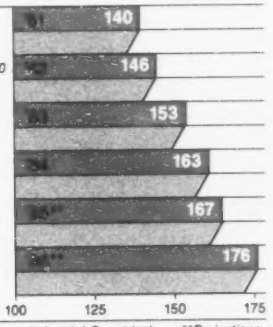


*Total Year **Projections N/A—Not Available
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service

BULGARIA

Gross Domestic Product (GDP): $50.4 Billion (1983 Est.)
Exchange Rate U.S. $1 = 1 Leva

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	2.1	1.9	1.8	2.3	2.9	3.4
Exports	1.4	1.2	1.0	1.1	1.3	1.4
Trade Balance	−0.7	−0.7	−0.8	−1.2	−1.6	−2.0
Industrial Production Index - Mfg. *Base 1970 = 100*						

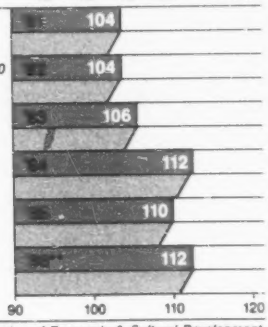


**Total Year (Western Industrial Countries) **Projections*
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service
N/A—Not Available

YUGOSLAVIA

Gross Domestic Product (GDP): $122 Billion (1983)
Exchange Rate U.S. $1 = 190 Dinars

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	137	175	223	324	441	N/A
Foreign Trade* *Billions Dinars*						
Imports	45	57	96	156	275	N/A
Exports	32	44	78	133	256	N/A
Trade Balance	−13	−13	−18	−23	−19	N/A
Industrial Production Index - Mfg. *Base 1980 = 100*						



Source: Organization of Economic & Cultural Development
**Monthly Average N/A—Not Available*
***Projections*

cars, electronic steering components and electrical goods.

Investment in 1984 was $8.1 billion representing a 2 pct increase over 1983. The forecast for 1985 is expected to be about the same.

West Germany is Bulgaria's main trading partner. Machinery and equipment account for 48 pct of Bulgaria's total exports. Some 46 pct of its imports are fuels, minerals and metals; 34 pct, machinery and equipment.

To encourage greater Western involvement in Bulgarian trade, the country issued a decree in 1980 permitting joint ventures with western companies.

Trade with the U.S. has centered on agricultural commodities. The best prospects for U.S. exports are products that will help modernize Bulgaria's industrial and agricultural industries. Such products as metal-working machines, computer technology, mining equipment and analytical and scientific equipment are bright spots for U.S. manufacturers.

YUGOSLAVIA

Yugoslavia is positional somewhere between East Europe and the West. It is a communist country which has distanced itself from the USSR and cultivated relations with the capitalist powers. To some extent, it is suffering because of this. Some 47 pct of its $10.2 billion exports in 1984 went to socialist countries, while 45 pct of its $11.9 billion imports orginate in the West. Not only does it have an adverse balance of trade, it also suffers from a shortage of foreign exchange.

By far its most pressing problem, though, is inflation. . .80 pct in the last 12 months, the highest in Europe. According to one Yugoslavian economist, there is little hope of solving this problem until 1990. The question will be, how to get through the next five years.

The leadership says it cannot close factories and displace workers. Nor does it want to resort to Soviet-type price regulation which will stymie supply.

Industrial output increased by 5.5 pct in 1984 and 4 pct is planned for 1985. The first half of 1985, was poor and it is doubtful if the target will be met. Basically, Yugoslavia has a sound industrial infrastructure. A great deal of investment has been made in new machinery over the past two years.

The problem is to find an outlet for Yugoslav products. Much of the capacity is under-utilized. The Yugoslavs have complained about protectionism in their main Western markets and they have approached the EEC with proposals for a new agreement. They want either free access or higher quotas for some 90 key products. These comprise 50 pct of their exports to the EEC.

The country has a flourishing automotive industry and the company, Crvena Zastava is beginning a drive to sell its Yugo 55 in the U.S. market. Yugo has already done surprisingly well in parts of Europe and is regarded as one of the best East European cars. Crvena Zastava estimates that it will sell 10,000 Yugo 55s in the first year, increasing to 150,000 by 1989. The car will sell for less than $4000.

An ambitious plan is for the country to build its own supersonic jet fighter. Other projects include helicopters, missiles, other aircraft and advanced electronic equipment. The Yugoslavian government says it seeks foreign capital in the form of joint ventures rather than loans and credits.

CZECHOSLOVAKIA

The Czechoslovakian economy has been stagnant since 1981. There are signs, however, that investment is beginning to pick up in such areas as machinery, equipment and construction.

Traditionally, Czechoslovakia has been a leader in certain manufacturing areas such as machine tools and turbine generators. But the country is becomming less competitive in the world market due mostly to the government's lack of an effective plan to improve foreign trade.

Czechoslovakia is currently developing its Eighth Five-Year Plan (1986-1990). Various reports indicate that the country will continue to emphasize development of electronics, computers, robotics, pollution control, and energy

saving equipment. Industrial production is expected to continue generating about 62 pct of national income.

Czechoslovakia is increasing its export trade with both socialist and non-socialist countries. However, it is reducing imports from non-socialist trading partners.

Trade with the U.S. has fallen since 1980 because of the country's better than average grain harvests. U.S. exports of machinery and other non-agricultural goods fell in 1984 and 1985 due mostly to the high U.S. dollar.

Potential areas of export growth for U.S. manufacturers include technology to improve the country's ailing industrial plants and energy-saving equipment.

HUNGARY

In terms of economic reform, Hungary is Comecon's "pace-setter" with policies aimed at bringing its domestic price structure in line with world market levels.

Hungary's economy is heavily dependent on foreign trade since it lacks raw materials. The government's main concern is conserving energy and increasing agricultural productivity.

Hungary has emphasized a policy of slow growth in order to promote economic adjustment. During 1984, its modest economic targets were realized: national income expanded by 3 pct and the average real income per capita increased by 1 pct. Investments were also down 1 pct. As a result of this adjustment, industrial activity and imports are expected to grow slowly during the next few years.

In the first half of 1985, Hungary recorded a trade deficit, against a 1984 trade surplus of $300 million for the same period. Exports dropped in foodstuffs and metallurgical products. Hungarian aluminum prices dropped by 20 pct and manufactured products dropped 4 to 5 pct. The country had to purchase energy with hard currency to counter the severe winter of 1984-85.

The country's Sixth Five-Year Plan (1981-86) called for a stable economy to maintain the standard of living. Hungary's overall economic development is second only to the GDR. This is a result of a reform program begun in 1968 (The New Economic Mechanism) that resulted in enterprise initiative that produced greater market orientation, greater availability of consumer goods and a higher standard of living.

Regarding trade with the U.S., Hungary is afforded Most Favored Nation tariff treatment stemming from a 1978 bilateral trade agreement. Since 1978, trade between the two countries has increased some 61 pct, from $166 million in 1978 to $268 million in 1983. Principal U.S. exports were animal feed, industrial machinery, agricultural equipment, chemicals and hides. Major Hungarian exports to the U.S. included buses, electrical equipment, metals, shoes and canned hams.

Potential areas of U.S. export growth include technology for agricral production, food processing and energy resource management.

ROMANIA

Romania is just now beginning to emerge from an economic slump that lasted from 1981 to 1983. Although falling short of government expectations, the economy during the past two years is showing a sign of erratic growth.

In 1984 industrial output rose 5.1 pct against a target of 8 pct. Growth in personal income was 3.4 pct against a target of 5 pct. Romania's current Five-Year Plan (1981-85) called for a 7.1 pct annual income growth rate. During the first quarter of 1985, industrial production was down compared to the same 1984 period. But in April industrial production rose 11.6 pct. This "see-saw" phenomena is a result of a severe winter during the early months of 1985. Romania may yet achieve its 7.5 pct growth rate target for 1985.

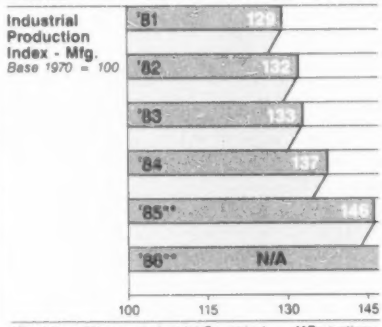
Romania's economic priorities include developing domestic fuel, energy and raw material resources and increase exports. In addition, the country wants to reduce dependance on foreign sources of supply.

Mechanical engineering, ferrous metals and chemicals account for 55 pct of Romania's industrial production.

CZECHOSLOVAKIA

Gross Domestic Product (GDP): $115 Billion (1984 Est.)
Exchange Rate U.S. $1 = .15 Krone

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	3.2	2.9	3.0	3.7	4.4	4.9
Exports	2.9	2.8	2.9	3.2	3.7	4.1
Trade Balance	−0.3	−0.1	−0.1	−0.5	−0.7	−0.8

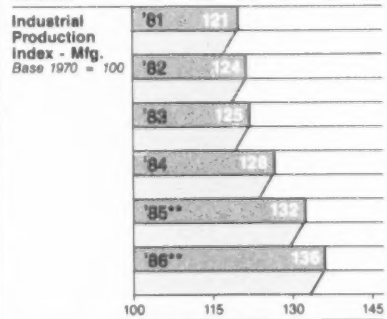


*Total Year (Western Industrial Countries) **Projections
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service
N/A—Not Available

HUNGARY

Gross Domestic Product (GDP): $60 Billion (1984 Est.)
Exchange Rate U.S. $1 = .02 Forint

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	3.5	3.3	3.2	3.6	4.3	5.0
Exports	2.8	2.8	2.9	3.7	3.8	4.2
Trade Balance	−0.7	−0.5	−0.3	−0.1	−0.5	−0.8

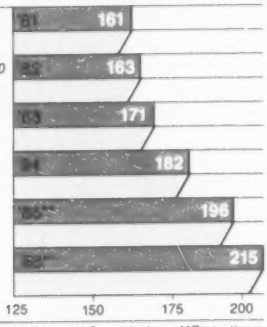


*Total Year **Projections N/A—Not Available
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service

ROMANIA

Gross Domestic Product (GDP): $68 Billion (1983 Est.)
Exchange Rate U.S. $1 = .08 Leu

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	3.5	1.9	2.0	3.0	4.3	5.0
Exports	3.7	3.4	2.5	2.8	3.2	7.6
Trade Balance	+0.2	+1.4	−0.4	−0.1	−1.0	+2.5

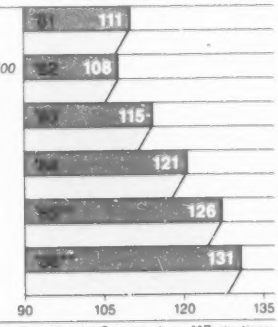


*Total Year (Western Industrial Countries) **Projections
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service
N/A—Not Available

POLAND

Gross Domestic Product (GDP): $160 Billion (1984 Est.)
Exchange Rate U.S. $1 = .64 Zolty

	'81	'82	'83	'84	'85**	'86**
Wage Cost-Mfg. *Base 1980 = 100*	N/A	N/A	N/A	N/A	N/A	N/A
Foreign Trade* *Billions U.S. Dollars*						
Imports	4.4	3.1	2.8	3.4	4.1	4.6
Exports	3.9	3.6	3.6	4.0	4.7	5.2
Trade Balance	−0.5	+0.5	+0.8	+0.6	+0.6	+0.6



*Total Year (Western Industrial Countries) **Projections
Sources: U.N. Economic Committee for Europe
CMEA Data yearbook 1981
NATO External Economic Relations
Barclays Bank, U.K.
National Westminster Bank
Forecast of Wharton Planned Economies Service
N/A—Not Available

Potential areas of U.S. export growth include agricultural machinery and energy equipment.

POLAND

The Polish economy in the first half of 1985 proved to be depressing.

The country is looking for a quick-return on exports and new export-oriented activities to pay off the $1.6 billion due to Western creditors during 1984-87.

By the end of 1984, Poland's hard currency debt had risen to $27 billion. Liabilities to Comecon lenders amounted to 5 billion Transferable Rubles ($6.6 billion). The year saw the Polish mechanical and electrical engineering sectors failing to meet a planned 30 pct export sales rise to the West. Instead, deliveries of raw materials, primary and intermediate products accounted for the rise in exports.

By mid-1985, industrial production had increased only 2 pct of which manufacturing rose 2.4 pct. The 1985 target is 4 to 4.5 pct.

In 1985 engineering exports to the West also rose 0.6 pct while the rise in imports was 18 pct.

Total exports of mechanical and electrical engineering products, declined by 19.3 pct during the first five months of 1985, compared with the same period in 1984. The 1985 target was an increase of 23.5 pct.

Investments appear to be under better control. Investment is up 5.2 pct in machinery and equipment and down 1.4 pct in new building construction.

New export sectors for Poland are expected to open up following a trade pact signed with the Republic of China. Trade in 1984 was $200 million with China. Poland also signed a $9.2 million barter deal with China in which 1500 "Polonez" cars, trucks, buses and construction vehicles will be sent to China in exchange for cotton and tea.

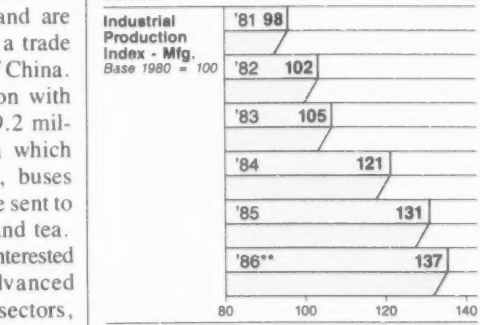
In the future Poland will be interested in new equipment for its advanced metallurgical and engineering sectors, primary electrical engineering and electronics, coke production, coke-based chemistry products, aluminium and copper processing and its steel industry. Items on the shopping-list include power-electronic drive systems and ac induction motor technology, updated dc motor technology, automation, switchgear, robotics and ways of building up its electronics industry. Poland wants to produce 16-bit microprocessors and 64K memories. In its steel plants, Poland has a need for vacuum-degassing, continuous casting and quality steel production equipment, computers and systems.

Poland also needs to increase its spending in research and development. It plans to devote 2 pct of its GNP to research by 1986 and 3 pct by 1990. The Polish communist party's central committee believes the country is falling behind its neighbors, technologically. More funds will be made available for imports of scientific equipment and computers. The underlying constraint will be the servicing of its $27 billion debt. Poland's central party committee has asserted that economic growth must be based on productivity gains and improved efficiency.

DENMARK

Gross Domestic Product (GDP): $63 Billion
Exchange Rate U.S. $1 = 9.5 Danish Kronor

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	109	117	124	130	132	134
Foreign Trade* *Billions Danish Kronor*						
Imports	10.4	11.6	12.4	14.3	16.1	16.9
Exports	9.5	10.5	12.2	13.8	14.7	15.3
Trade Balance	−0.9	−1.1	−0.2	−0.5	−1.4	−1.6



Source: Organization of Economic & Cultural Development
*Monthly Average
**Projections

Scandinavia

Sweden, the country which normally leads a recovery in Scandinavia, will come to an abrupt halt with its gross domestic product likely to post an increase of only 0.5 pct.

DENMARK

Traditionally, Denmark is an agricultural country, but in recent years it has heavily invested in industry. In 1984, for instance, industrial investment jumped by 30-35 pct, the highest rate in 20 years. Industrial output for 1985 was around 5 to 6 pct up over the previous year.

Like other Scandinavian countries, Denmark suffers from wage inflation, with nearly a 40 pct rise over the previous six years. This tends to hamper exports and, indeed, the adverse trade balance is expected to rise slightly in 1986.

The government has a 2 pct guideline in wage increases, but trade union demands are for the introduction of a 35-hour work week with little or no pay loss.

SWEDEN

After three years of good growth, economic activity is expected to come to a standstill next year according to a recent forecast of the Swedish National Institute of Economic Research. The gross domestic product is likely to show an increase of less than 0.5 pct, following rises of 3.3 pct and 2.5 pct respectively in 1984 and 1985.

Inflation at just over 7 pct in 1985 is above the European average. There are expectations that this can be brought under control with a forecast of around 5 pct for 1986.

Persistently high wage increases have served over several years to undermine Sweden's international competitiveness. This is particularly serious because the country lives by exports. Nearly half of the country's engineering output is sold abroad. For 1986, industrial production is expected to rise 5 pct over 1985, slumping as the year progresses.

To combat high manufacturing costs, Sweden has been among the forerunners of advanced automation and has pioneered robotics and automatic assembly. Asea is today the largest robot supplier in Europe and is growing at the phenomenal rate of 50 pct per year. The company is well established in the U.S. market and also is manufacturing robots in Japan.

Sweden's thriving automotive industry and its two carmakers—Volvo and Saab—were both profitable last year. Both rely heavily on sales in the U.S. market.

The outlook is mixed for Sweden. The devaluation of 1982 boosted performance in the two subsequent years. But underlying structural problems remain. Economic growth peaked in 1984 and it looks as if another devaluation could be required to restore stability.

NORWAY

Norway is a major exporter of oil and gas. Over the past few years this has led to large current account surpluses. The country has the same basic problem as Sweden: sharply rising wage costs. This has tended to make manufactured exports uncompetitive, and in recent years there has been a loss of market share abroad.

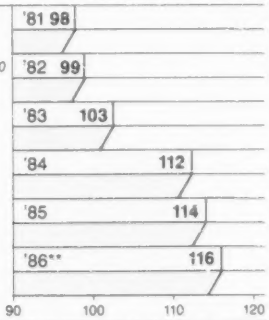
Inflation continues to fall back in 1984, averaging 6.2 pct against 8.4 pct in 1983. The inflation rate is, however, still higher than the OECD average of 5 pct. The government's target was to achieve 5.7 pct in 1985.

Over the last few years, Norway has deliberately cultivated high technology and moved into the numerical control quite early. Sweden provided a good market for companies like Kongsberg in control systems for advanced manufacturing. The country is making a determined effort to supply the international automotive industry with sophisticated components. The government is providing assistance to a small, but highly active group of companies in this field.

SWEDEN

Gross Domestic Product (GDP): $71 Billion (1985 Est.)
Exchange Rate U.S. $1 = 7.9 Swedish Kronor

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	110	118	127	141	155	162
Foreign Trade* *Billions Kronor*						
Imports	12.1	14.5	16.7	18.2	21.4	25.0
Exports	12.07	14.0	16.7	20.2	21.4	22.6
Trade Balance	0	−0.5	0	−2.0	0	−2.4

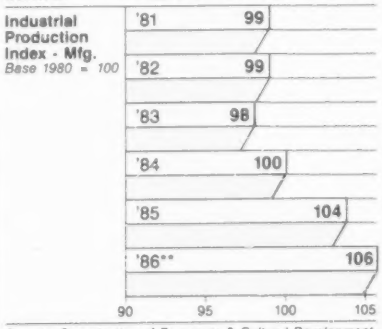


Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*

NORWAY

Gross Domestic Product (GDP): $62 Billion (1984)
Exchange Rate U.S. $1 = 7.8 Norwegian Kronor

	'81	'82	'83	'84	'85	'86**
Wage Cost-Mfg. *Base 1980 = 100*	110	121	132	146	150	154
Foreign Trade* *Billions Norwegian Kronor*						
Imports	7.5	8.3	8.2	9.4	10.4	N/A
Exports	8.7	9.4	10.9	12.8	13.4	N/A
Trade Balance	+1.2	+1.1	+2.7	+3.4	+3.3	N/A



Source: Organization of Economic & Cultural Development
**Monthly Average*
***Projections*
N/A—Not Available

CAPITAL SPENDING

Why It Will Be Flat This Year

☐ ***In this PRODUCTION Magazine exclusive survey, manufacturers reveal that their purchases of equipment in 1986 will not be much different from last year.***

☐ ***Major purchases of equipment from offshore suppliers will be evident in 1986 as well as the use and implementation of advanced manufacturing technologies.***

By Ed McCallum

BASED ON THE SURVEY CAPITAL EQUIPMENT requests will reach $10.7 billion for 1986. Of that total, respondents expected to obtain approval for $8.43 billion worth of equipment purchases. This figure was being used for all projections.

The spending level, while down from a year ago, would approximate actual spending during 1985.

Our 1986 findings, obtained through our annual survey (this is our 18th) conducted last August and September, checked equipment purchases, and the reasons behind these needs.

Typical plant spending for machinery and equipment is depicted in the chart on the following page.

The survey indicated that plants were operating at 76 pct of capacity in August-September, 1985, down slightly from one year ago. Of the total, 51.8 pct of the respondents plan to operate at higher levels of capacity this year while only 5.4 pct believe operating rates will be at a lower level. And that's the good news. The bad news is that only 41 pct of the respondents expect to have increased capital budgets, compared to 51 pct a year ago; 17.4 pct reported lower budget requests. Add to that, only a third (33.8 pct) of those surveyed report incoming orders up. This is compared to 47 pct last year. These negatives help confirm more moderate investment plans in 1986.

As in past years, most of those surveyed (64.8 pct) continue to zero-in on direct labor as the primary cost reduction target for 1986. This is a difficult position for PRODUCTION Magazine to justify as materials costs, as a percentage of attributed cost, was 50 pct higher than direct labor in the make-up of the manufactured cost. Other cost reduction efforts targeted for improvement are: in-process inventory, 28.8 pct; material costs, 28.4 pct; scrap-rework, 25.8 pct; in-direct labor, 22.7 pct, and perishable tools and supplies, 9.1 pct.

Offshore Suppliers

Of total respondents, 53.8 pct reported the purchase of a portion of equipment needs from offshore suppliers. For these respondents, 40 pct of the total planned investment will be placed offshore and will be used primarily to fund: metalcutting machine purchases, (56.7 pct); metalforming equipment purchases, (14.7 pct) and gaging-inspection-testing equipment, 14.6 pct of the respondents. Reasons given for offshore sourcing: equipment quality (72.9 pct), prices (69.5 pct), availability (38.1 pct) and service (21.3 pct).

First year return-on-investment (pre-tax) requirements remain virtually unchanged at 32 pct, on average. No change over the years still can mean manufacturers are faced with equipment payback periods of 2½-2¾ years.

How Plants are Spending

% Total Investment 1986	Total Projection (Mil $)	% Change 1986 from 1981-1985 Average	Machine/Equipment
38.5	3245*	+ 4.0	Metalcutting
11.4	961	- 21.3	Assembly
11.4	961	+ 40.7	Other
11.2	944**	- 2.7	Metalforming
7.2	606	+ 16.1	Gaging/Inspection/ Testing
6.5	547	- 11.0	Cleaning/Finishing
5.2	438	- 8.7	Material Handling
4.0	337	- 18.4	Weld/riveting/brazing
2.6	219	Same	Plastic Molding
2.0	168	- 16.7	Heat Processing

*$1931 million to sourced domestically
**$642 million to be sourced domestically

Survey Scope: *Plants reached by PRODUCTION Magazine in: Fabricated Metal Products (SIC 34); Machinery, except Electrical (SIC 35); Electrical Machinery (SIC 36); Transportation Equipment (SIC 37); and Instruments (SIC 38). 1986 figures are projected from 2017 respondents from 12,000 plants contacted in keeping with past procedures.*

Plant Employment and Capital Spending

Plant Employment	Machinery/Equipment Expenditures
Less than 50 persons	$ 146,382
50-99 persons	$ 199,951
100-499 persons	$ 480,971
500-999 persons	$1,277,087
1000 or more persons	$4,015,189

Of the total, 36 pct reported having approval equipment budgets as of last August, and 44.9 pct expected approval by year-end with the balance during the first quarter of this year. As a group, the 64 pct that reported they were awaiting approval, estimated they expected to receive only 72 pct of the funds requested. Nine percent of the dollar value of planned-for equipment has already been placed with suppliers.

While investments in metalcutting and metalforming machinery continue to take about 50 pct of investments, advanced manufacturing technologies continue to make inroads and are beginning to successfully compete for investment dollars. You'll note in the investment by type of equipment table on page 66 the $961 million reported in "other" is primarily for system and control investments. Many respondents wrote in that they didn't know where to assign these investments.

Over the next three years, 56.7 pct of the total respondents plan to purchase CNC equipment, up from 52.1 pct one year ago and up 64 pct over the past ten years. In addition, 67.0 pct of you report use of CNC, up from 62.8 pct reported in last year's survey and 59.3 pct two years ago. Of those plants planning CNC equipment purchase, only one plant in eight will be an initial installation; 70.7 pct of the plants employ 100 or more persons (27.2 pct in plant of 500 or more); the 88.5 pct that currently operate CNC equipment operate a median of 4 machines-the range of CNC machines operated ran from 1 to 300; and 65.9 pct of the respondents will spend 42.5 pct of your total capital investments appropriation with offshore suppliers.

Of total respondents, 11.4 pct are planning electrical discharge machine (EDM) purchases over the next three years. This is about the same level of purchase activity as last year and up about 10.5 pct over two years ago. Of the total respondents, 21.8 pct report EDM use with installations spread over 94 industries (standard industrial classifications) with over three-quarters (77.5 pct) of these plants employing 100 or more persons. Of these planning a EDM purchase: 54.8 pct are first time

buyers; 41.3 pct will purchase RAM (standard) machines; 63.9 pct will purchase wirecut EDM and slighty more than 10 pct will purchase both types. Major EDM purchase activity is shown in the chart at right.

Use of Advanced Manufacturing Technologies

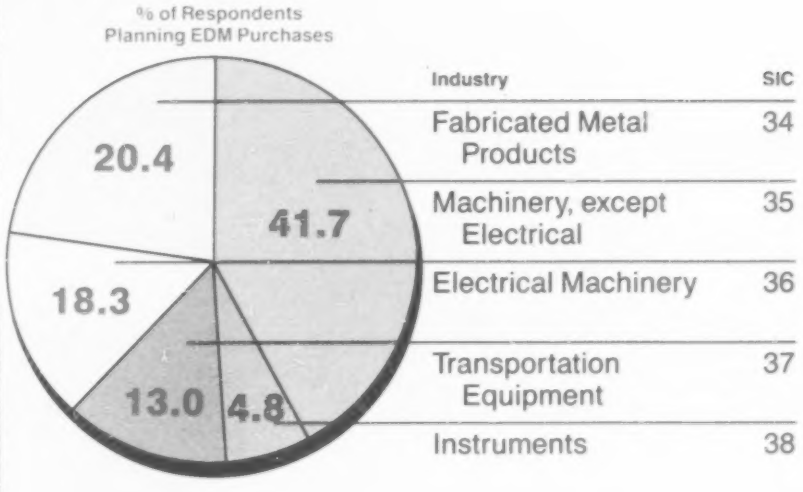
COMPUTERS: Nearly four out of five respondents (79 pct) plan to apply computers and systems in manufacturing operations over the next three years. In fact, some respondents report practically their entire planned investments will be used to initiate or expand their use of computerized data systems in the manufacturing area. And while the computer inroads to help control manufacturing efficiency, cost and quality may appear to have lagged other computer applications in the plant, the fact is that 2.6 times more plants plan computer application over the next three years than did respondent plans reported in our survey of five years ago.

Of those surveyed 56.9 pct of those planning to install or expand the use of computers in manufacturing are located in plants employing 50-500 and only 16.6 pct in plants of less than 50 employees.

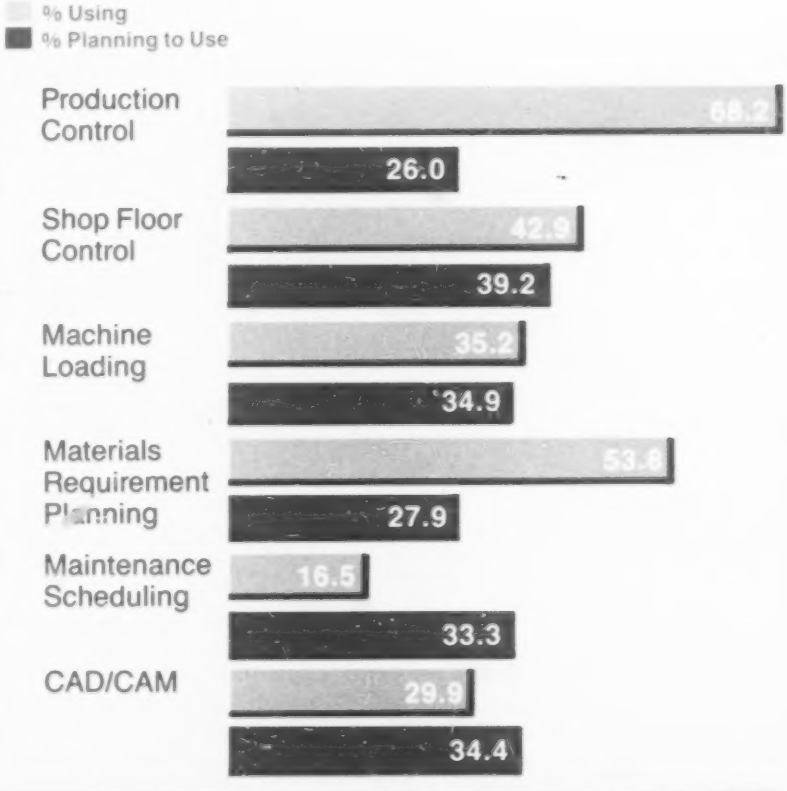
MANUFACTURING CELLS: 19.3 pct are planning to purchase cells by 1988. (A manufacturing cell was defined in the survey as comprising one materials handling device servicing multiple machines, coordinated and paced by a computer or programmable controller). Of these, 40.1 pct (250 plants) report they currently operate cells, 92.9 pct of these planning use are located in plants employing 100 or more—over half in plants employing 500 or more. Typically, the plants planning cell purchase will spend $1-million (median) on production equipment; 21.6 pct of these plants will spend between $2 million to $50 million in 1986.

FLEXIBLE MANUFACTURING SYSTEMS: 15.6 pct plan to purchase FMS over the next three years. Like cells, purchase plans tend to be concen-

EDM Purchases by SIC



Computerized Data Systems Usage



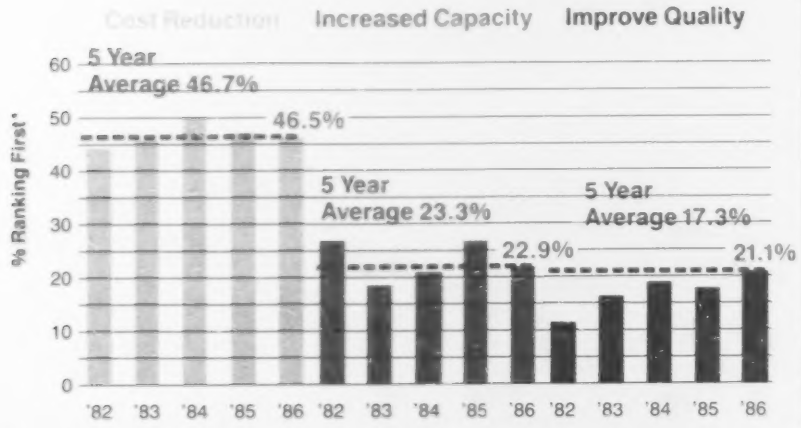
Robotics and How They Will be Used

Robot Applications	Currently Use	Plan to Use
Arc Welding	11.9%	25.2%
Spot Welding	6.0%	10.2%
Assembly	16.8%	35.8%
Machine Load/Unload	27.2%	51.9%
Material Handling	12.2%	30.4%
Spray Painting	9.3%	20.0%
Other	3.6%	3.3%

Base: Respondents planning robot purchases 1986-88.

The Reasons Behind Equipment Purchases

(TOTAL RESPONDENTS 1982-1986)



**Some respondents ranked more than one motive first.*
Source: PRODUCTION'S Capital Spending Survey 1982-1986.

Cost reduction continues as the primary motive to buy equipment. Capacity as a primary motive has decreased in importance reflecting the current flat utilization rates in discrete parts manufacturing. Quality improvement has jumped substantially and is ranked almost as important as increased capacity. Other motives, not grouped include: new products/models—13.1 percent ranking first; more machine/process flexibility—8.7 percent ranking first; more make—less buy—5.8 percent ranking first; followed by energy reduction—ranked first by only 2.8 percent of the respondents reflecting the current availability of energy.

trated in larger plants with 91.2 pct of these planning FMS purchase located in plants employing 100 or more, and 51.7 pct in plants with 500 or more persons. (An FMS was defined in the survey as comprising multiple material handling devices servicing multiple machines with a computer responsible for coordinating, pacing and scheduling). Based on this definition, 91 plants report they currently operate FMS of one type or another (metalcutting, metalforming, assembly, etc.); 14.6 pct (46) of the plants planning purchases intend to spend $5 million or more on manufacturing equipment in 1986. As a group, these 46 plants intend to spend $582.2 million this year.

LASERS: Lasers continue to capture attention and capital dollars as 15 pct reported plans to include their purchase 1986-88. Laser purchase intentions, while a little lower than reported last year, continue to cause a significant shift in investment from the more traditional production equipment purchase pattern. Lasers will be purchased for cutting operations (38.4 pct of these planning purchase), for welding (21.2 pct), drilling (16.2 pct), and heat processing (4.6 pct). Gaging and measuring laser use will account for the largest share with 42.7 pct of these respondents reporting planned purchase activity.

ROBOTICS: Better than a third of all of the respondents are planning robotic purchase within the next three years. Most of those that plan robotic purchase over that period (88 pct) are located in plants employing 100 or more persons. Industries which continue to be heavily committed to robotic usage and investment include: Fabricated structural steel products (SIC 344), forgings and stampings (SIC 346), fabricated metal products (SIC 349 with heavy activity in valves and pipe fittings), construction mining, oil field and material handling (SIC 353) metalworking machinery and equipment-both as users and OEMs (SIC 354), general industrial machinery (SIC 356), electronics components and accessories (SIC 367), electrical lighting and wiring devices (364) motor vehicles, motor vehicle parts (SIC 371) and measuring and controlling instruments (SIC 382). **P**